Developing New Future Scenarios for the U.S. Coast Guard’s Evergreen Strategic Foresight Program

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Preface

This report documents support by Homeland Security Operational Analysis Center (HSOAC) to the U.S. Coast Guard’s Evergreen strategic foresight activity. The objective was to help develop scenarios that postured Evergreen to better bridge the gap between future challenges and near-term plans, which typically focus on the urgent needs of the present. HSOAC analysts reviewed prior Evergreen activities, examined Coast Guard strategy-making and planning processes, adapted an approach for developing scenarios, and narrated a set of exemplar global planning scenarios. Although the scenario development process and resulting example scenarios focused on a Coast Guard planning context, the approach and considerations described in this report might be useful to other organizations with long-range planning needs.

This research was sponsored by the Coast Guard Office of Emerging Policy and conducted within the Strategy, Policy, and Operations Program of the HSOAC federally funded research and development center (FFRDC).

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The results presented in this report do not necessarily reflect official DHS opinion or policy. For more information on HSOAC, see www.rand.org/hsoac. For more information on this publication, see www.rand.org/t/RR3147.
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Summary

The U.S. Coast Guard’s motto is *Semper Paratus*—always ready. But for what? The Coast Guard is expected to perform 11 statutory missions subjected to a variety of authorities, resulting in a complex operating environment and a highly challenging planning process. The Coast Guard must accommodate the spectrum of day-to-day needs (U.S. Coast Guard Academy, undated). It is also expected to respond to a variety of contingencies, such as natural and human-caused disasters, diplomatic assistance, and medical support. Overall, the Coast Guard can anticipate some, but not all, of the daily demands on its operations. Furthermore, future changes to the operating environment in the physical, technological, economic, geopolitical and international security, policy and regulatory, and social domains will likely create additional stressors on service resources, in addition to changing the makeup of the service (e.g., people, capabilities) itself.

For this research, the Coast Guard asked the Homeland Security Operational Analysis Center (HSOAC) to review prior Coast Guard strategic foresight activities conducted via the Evergreen program. This analysis was intended to serve two purposes. First, it was to inform subsequent shaping of a method of designing scenarios for a new series of Evergreen analyses by identifying positive historical attributes of past Evergreen iterations. Second, it sought to identify aspects of the program that could use improvement to enhance the value of strategic foresight activities and analyses. In this report, we propose an updated qualitative scenario development approach. This approach combines a selection of relevant methods from the resilience and decisionmaking-under-deep-uncertainty communities of practice that the Coast Guard can apply to provide greater strategic foresight. Specifically, we propose three macro-level methodological steps to formulate global planning scenarios for use in Evergreen analyses:

1. Start with a decision context to frame scenario development and subsequent analyses.
2. Employ a stressors-and-shocks framework to gather information about trends and contingencies that have the potential to affect the service’s operating environment.
3. Develop scenario families (representing intersections of key trends) and combine them with relevant shocks to simulate the tension between day-to-day needs and sudden contingencies that take up large amounts of resources.

We applied this scenario development method to create exemplar scenarios that could be used as a starting point for exploring readiness in the context of assets and personnel. This summary

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1 Coast Guard missions are categorized as homeland security (ports, waterways, and coastal security; drug interdiction; defense readiness; migrant interdiction; and other law enforcement) or non–homeland security (aids to navigation, search and rescue, living marine resources, marine safety, marine environmental protection, and ice operations).
provides further detail on Evergreen, our review of Evergreen activities, our updated scenario development method, and examples of Evergreen global planning scenarios.

Evergreen: A U.S. Coast Guard Program to Support Strategic Foresight

The Coast Guard must organize, train, and equip itself to conduct current and future operations. Limited budgets, combined with the sheer diversity and rapid rate of change in activities in the maritime domain, make it challenging for the Coast Guard to plan and prepare for current and future operations. One of the means by which the service can consider future changes and their impacts is through the Evergreen program run by the Coast Guard Office of Emerging Policy.

Project Evergreen’s origins date back to 1998, when it was inaugurated as the Long View program. Its current name was adopted in 2002. Evergreen was modeled, in part, on the strategic planning group that worked for the Chief of Staff of the Air Force. Although Evergreen’s methods have been adapted over the years, the central approach relies on participatory discussion of qualitative scenarios representing futures 15 to 25 years hence. For example, a group of Coast Guard planners would be presented with four alternative futures representing change along two axes (say, climate and economic activity). After splitting into four teams, one for each alternative future, participants would construct a mix of Coast Guard assets (e.g., cutters, helicopters) best suited for operations in each future. Then, participants would compare results and examine how these different proposals fare under conditions presented in the three alternative futures not originally examined when constructing the “ideal” asset mix (a basic test of robustness). Since 2002, there have been four iterations of Project Evergreen (designated Evergreen I through IV), each lasting four years, corresponding to the term of each commandant of the Coast Guard. Evergreen V is underway at the time of this writing.

Evergreen’s most visible products have been a series of reports regarding Coast Guard strategy, goals, potential future challenges, and scenarios (see U.S. Coast Guard, undated a). From the outset, the intent of Evergreen was to contribute to a more forward-thinking Coast Guard approach to future challenges. As a highly tactical operational service with extensive demand for its contributions, the Coast Guard often struggles with the “tyranny of the present.” Evergreen was intended to counter the Coast Guard’s focus on addressing short-term needs by exploring potential challenges that might arise decades into the future, as well as how they could be mitigated by anticipatory decisions or actions. However, Evergreen has not been fully successful in doing this for several reasons, which we describe further in the next section.
An Updated Scenario Development Approach Will Help Overcome Challenges

This report is focused on developing a new set of global planning scenarios to support Evergreen V. These scenarios provide updated content for use in Evergreen strategic foresight activities. They also exemplify a structured, repeatable process for generating scenarios that could help overcome some of the historical problems Evergreen has faced in stimulating anticipatory decisionmaking within the Coast Guard.

Understanding Evergreen’s historical successes and challenges helped us better frame a scenario development process and narratives. Using documents and interviews with a wide group of Coast Guard personnel who have led, participated in, or otherwise employed Evergreen products or experiences, our team of HSOAC analysts compiled a series of lessons (good and bad) from previous Evergreen activities. The logic model presented in Figure S.1 reflects our understanding of Evergreen’s inputs, activities, outputs, outcomes, and strategic goal and the linkages between these elements. It reflects how Evergreen currently intends to operate (based on historical development of the program). It does not (by itself) provide an assessment of how well Evergreen has met its goals in the past.

Figure S.1. Simplified Evergreen Logic Model

We organized the lessons based on the individual components of the logic model. We briefly summarize these lessons in Table S.1.
Table S.1. Lessons from Evergreen's History

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Relevant Stage of the Logic Model</th>
<th>Inputs</th>
<th>Activities</th>
<th>Outputs</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having limited resources has constrained Evergreen's contributions.</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
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<tr>
<td>Evergreen's outputs have been generally well regarded, with some</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>caveats.</td>
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<tr>
<td>Evergreen outputs could be timelier.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Evergreen's impact has been a strong function of senior leadership</td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>engagement.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Evergreen could have a greater impact if its outputs were better</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>integrated into Coast Guard processes.</td>
<td></td>
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<td></td>
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<tr>
<td>Cultural and institutional factors have inhibited Evergreen's impact.</td>
<td></td>
<td></td>
<td></td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>Evergreen's impact was not always broadly recognized within the Coast</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Guard.</td>
<td></td>
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</tr>
</tbody>
</table>

For the purposes of shaping scenarios and the way in which they are created, three primary points stood out: (1) Generally speaking, Evergreen participants find the experience of considering the implications of longer-range future scenarios for Coast Guard operations valuable; (2) scenarios and foresight activities are not always or entirely successful at enabling deliberation of important trade-offs related to hard problems; and (3) users struggle to incorporate Evergreen products into their planning and decisionmaking processes, so it is difficult to trace the program’s potential impacts.

To better understand this third point, our team of HSOAC experts conducted a limited examination of the broader Coast Guard strategy-making and planning context that Evergreen scenario-based analysis could help inform. We looked at both the Coast Guard strategic library and the Planning, Programming, Budgeting, and Execution process. The former includes a series of documents that the service has published in recent years to articulate—to internal and external audiences—Coast Guard priorities, concerns, and relationships with other organizations. The latter is a highly complex series of processes that ultimately links needs with budget requests.

We found both opportunities and challenges for Evergreen scenario-based analysis. Coast Guard strategy-making and planning activities generally lack obvious connections to any structured, systematic strategic foresight activities, and no obvious guidance is available on how to connect the more distant future with nearer-term plans and actions. The strategic library does tend to focus the bulk of its content on emerging or future issues, and Evergreen appears to have motivated some of the content in that library. However, specific information linking drivers of change to Coast Guard decision points that would help facilitate subsequent implementation planning and execution is lacking. Although a variety of planning-type documents and inputs are considered in Planning, Programming, Budgeting, and Execution, none of them has a robust connection with the work that Evergreen does. Furthermore, long-term issues do not appear to be
strongly or typically connected with nearer-term plans and budget requests in ways that move from generic concerns to specific actions.

The main implications for scenario development from this limited examination of Coast Guard strategy making and planning is the need to emphasize trade-offs for specific decisions. The scenario families, which we summarize in the next section, are also designed to envision futures that evolve from a common point (today) but take different paths moving forward. Such scenario families could help planners not only connect their near-term choices to the more distant future but also ensure that these choices offer some degree of resilience regardless of the path taken.

New Global Planning Scenarios Demonstrate an Updated Development Approach

We propose a structured, repeatable process for Evergreen scenario development. The proposed process would replace a diverse historical set of Evergreen approaches, which include expert elicitation on key issues; adaptation of existing Coast Guard or other narratives; and structured analytic techniques, such as using a 2×2 matrix structure to consider more than one axis of change.

For the purposes of this research, we define global planning scenario as an alternative vision of a multidimensional future environment that incorporates information about trends and perturbations taking place across wide geographic areas and enables the analysis of relevant trade-offs for decisionmaking.²

The approach we proposed for developing global planning scenarios for Evergreen rests on three concepts, which are meant to be applied sequentially. The first concept, which we borrowed from the family of decisionmaking-under-deep-uncertainty approaches, consists of shaping scenarios based on the decision they are intended to support. In doing so, a scenario becomes an output of, not an input to, an analytic process. These scenarios are intended to be used as part of a scenario-based analytic process for decision support. We discuss one example implementation scheme that is consistent with Evergreen’s mission and the scenarios discussed in this report in an accompanying volume (Van Abel, Wilson, and Anania, unpublished).

To determine what decisions our scenarios would be intended to support, we leveraged guidance in Coast Guard Strategic Plan: 2018–2022 (U.S. Coast Guard, 2018b) to scope our choices of stressors and shocks (discussed next) for scenario development. The strategic plan discusses the service’s strategic priorities and connects strategic planning efforts and ongoing

² Although some phenomenon might drive change across the entire globe—or a wide swath of it—the impacts most important to the Coast Guard’s operating environment might be felt at a more regional or local level (e.g., in the form of a particular oil spill, drug transport corridor, or hurricane).
work to enterprise management (Figure S.2). These priorities provide important evidence of the service’s long-term goals.

**Figure S.2. The Coast Guard’s Strategic Framework**

![Coast Guard Strategic Plan 2018-2022](image)

**SOURCE:** U.S. Coast Guard, 2018b, p. 8.

We focused our exemplar scenario families on the first priority listed in the strategic plan: Maximize readiness today and tomorrow. We chose to focus on this priority because the plan states that this is the most important and because it is inherently forward-leaning. Further, the types of solutions that might be considered within readiness initiatives (e.g., acquisition, plans for personnel) have long-term implications. To reduce the scope of the analysis, we focused on the first two objectives of the readiness priority: cultivating the mission-ready total workforce and modernizing assets, infrastructure, and mission platforms.

The second central concept is the stressors-and-shocks framework that guides the organization and articulation of (in this case) Coast Guard mission–relevant drivers of change. We adapted this concept from an ample body of work on resilience in different contexts. Stressors are long-term trends that will likely strain the capacity and capability of Coast Guard resources and could degrade mission readiness. Shocks are sudden, large-scale disruptions that would likely affect the delivery of Coast Guard missions, the condition of the general population, or the maritime operating environment. Some shocks (e.g., a terrorist attack) might occur very suddenly, whereas others (e.g., a disease outbreak) might progress over the course of days, weeks, or months. The output of employing this framework is a curated and organized list of factors relevant to the Coast Guard and the decision context that can be used to help construct alternative future scenario narratives.
Finally, the third central concept of our approach consists of reducing the universe of possible scenarios suggested by the stressors-and-shocks framework by developing some example scenarios. To do so, we elicited expert judgment (but this process could be supplemented by simulations, gaming, quantitative data analysis, or any combination of those) to identify two types of stressors that are most relevant to the success or failure of a Coast Guard objective related to a specific decision point. Visualizing these as orthogonal axes of change is a convenient means of defining a scenario family, which represents future change in different directions from a common starting point. We termed each quadrant of the resulting 2×2 matrix a scenario, each of which contains, conceptually, a large number of variants, or futures. Each stressor-based scenario within a family can theoretically be coupled with a scenario from another family (using the examples presented in Table S.2, a user could combine scenarios from the Workforce and Asset families) to form a richer narrative. Furthermore, individual scenarios can be amplified with the introduction of one or more relevant shocks that further stress activities in the scenario.

The scenarios we developed are novel in the context of Coast Guard decision analysis in several ways. First, we deliberately scoped them to specific topics of interest to Coast Guard decisionmakers. In this sense, they are outputs of, rather than inputs to, a strategic foresight process. Second, our concept of scenario families maps Coast Guard strategic choices along key axes of change that are most relevant for decisionmaking. Third, we designed narratives for shocks that can be layered on top of complex future worlds constructed from the scenario families.
Table S.2. A Summary of Example Evergreen Scenarios

<table>
<thead>
<tr>
<th>Scenario Family</th>
<th>Stressor-Based Scenario Nickname and Description</th>
<th>Example Shock Nickname and Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Workforce: Each scenario represents a type of Coast Guard workforce future realized by 2040 given possible market competitiveness of careers and specialization of Coast Guard mission requirements.</td>
<td>• Captain’s Got a New Gig: Focus moves from specialization to a successful recruitment strategy with reliance on a temporary and part-time workforce. • Up or Overboard: Missions are more specialized, and the service successfully recruits and develops skilled service members. • Try Switching to Aux: The Coast Guard has problems competing in the labor market to meet the capacity for a generalist workforce. • Silicon Sloop Slump: The Coast Guard prefers a highly trained and experienced workforce, eroding the personnel pipeline.</td>
<td>• Putting All Our Magnets in One Basket: A geomagnetic storm coupled with a cyberattack requires a response; there is a lapse in navigation capability; a fuel shortage ensues. • Quarantine Quagmire: Disease outbreaks and wildfires occur; port security needs increase at home and abroad.</td>
</tr>
<tr>
<td>Asset: Each scenario represents a sort of future emphasis placed on Coast Guard assets by 2040, given the pace of climate change impacts and rate of technology adoption.</td>
<td>• Sensing a Pattern: Artificial intelligence and automation technologies aid mission execution in a world with limited climate disruptions. • Shocks and Struts: Rapid technological change fosters unanticipated advances that help meet needs in a rapidly changing climate; climate change threatens supply chains. • Humdrum Doldrums: The rate of technological change and the pace of climate effects are low. • Things Go to 11: High impacts from climate change produce challenges; technological change and adoption levels are low.</td>
<td>• Oil and Water Don’t Mix: A vessel spills oil in Arctic waters as hurricanes batter the Gulf of Mexico and the United States contends with an emerging security issue. • Al Sur de la Frontera: An earthquake devastates Mexico, leading to humanitarian and immigration crises and a lapse in security.</td>
</tr>
</tbody>
</table>

Conclusion

The Coast Guard can take better advantage of its existing capabilities for scenario-based analysis. Furthermore, Evergreen strategic foresight efforts can be made more targeted and relevant for Coast Guard planning. The scenario development methods and example scenarios presented in this report posture the Coast Guard and Evergreen to better integrate slow-burning issues and unpredictable future changes into nearer-term decisions that can help prepare the service for upcoming challenges. The accompanying volume to this report (Van Abel, Wilson, and Anania, unpublished) lays out one way of using our scenarios in a decision support analysis.
Together, the scenarios and the implementation approach provide Evergreen with the analytic means to serve as a bridge between future challenges that could appear multiple decades hence and near-term planning functions that service the urgent needs of the present.

Without weighing the long view of changes in the operating environment alongside current or nearer-term demands, the Coast Guard will not be able to have full awareness of what blind spots might exist. The service’s motto—*Semper Paratus*—implies readiness for anything. Fulfilling that promise requires mindfulness of both the near and long terms and how change will affect the Coast Guard.
Acknowledgments

We would like to thank our action officers, CDR Kate Higgins-Bloom and LCDR David Smith, from the Office of Emerging Policy. We also thank CDR Eric Popiel for providing the inspiration for the Evergreen lesson analysis. We thank all the Coast Guard members who participated in the project workshop, survey, and interviews. The project team much appreciates Lisa Bernard’s assistance with editing the document. Finally, we appreciate the efforts of our three Homeland Security Operational Analysis Center quality assurance reviewers: Katherine Tiongson, David G. Groves, and Michael J. Mazarr.
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>ATON</td>
<td>aids to navigation</td>
</tr>
<tr>
<td>AV</td>
<td>autonomous vehicle</td>
</tr>
<tr>
<td>C4ISR</td>
<td>command, control, communications, computers, intelligence, surveillance, and reconnaissance</td>
</tr>
<tr>
<td>C5I</td>
<td>command, control, communications, computers, cyber, and intelligence</td>
</tr>
<tr>
<td>C5ISR</td>
<td>command, control, communications, computers, cyber, intelligence, surveillance, and reconnaissance</td>
</tr>
<tr>
<td>CCG</td>
<td>commandant of the Coast Guard</td>
</tr>
<tr>
<td>COMDTINST</td>
<td>commandant instruction</td>
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<tr>
<td>DAPP</td>
<td>Dynamic Adaptive Policy Pathways</td>
</tr>
<tr>
<td>DCMS</td>
<td>deputy commandant for mission support</td>
</tr>
<tr>
<td>DCO</td>
<td>deputy commandant for operations</td>
</tr>
<tr>
<td>DCO-81</td>
<td>U.S. Coast Guard Office of Performance Management and Assessment</td>
</tr>
<tr>
<td>DCO-X</td>
<td>U.S. Coast Guard Office of Emerging Policy</td>
</tr>
<tr>
<td>DHS</td>
<td>U.S. Department of Homeland Security</td>
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<tr>
<td>DI</td>
<td>drug interdiction</td>
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<tr>
<td>DMDU</td>
<td>decisionmaking under deep uncertainty</td>
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<td>DoD</td>
<td>U.S. Department of Defense</td>
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<tr>
<td>DR</td>
<td>defense readiness</td>
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<tr>
<td>EEZ</td>
<td>exclusive economic zone</td>
</tr>
<tr>
<td>FFRDC</td>
<td>federally funded research and development center</td>
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<tr>
<td>FY</td>
<td>fiscal year</td>
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<td>FYHSP</td>
<td>Future Years Homeland Security Program</td>
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<td>GNSS</td>
<td>global navigation satellite system</td>
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<tr>
<td>GPRAMA</td>
<td>Government Performance and Results Modernization Act of 2010</td>
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<tr>
<td>GPS</td>
<td>global positioning system</td>
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<td>H3N9</td>
<td>avian influenza C</td>
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<td>HSOAC</td>
<td>Homeland Security Operational Analysis Center</td>
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<td>IO</td>
<td>ice operations</td>
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<tr>
<td>IPL</td>
<td>integrated priority list</td>
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<tr>
<td>IRB</td>
<td>investment review board</td>
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<tr>
<td>LMR</td>
<td>living marine resources</td>
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<tr>
<td>MAR</td>
<td>mission analysis report</td>
</tr>
<tr>
<td>MEP</td>
<td>marine environmental protection</td>
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<tr>
<td>MS</td>
<td>marine safety</td>
</tr>
<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
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</tr>
<tr>
<td>MTS</td>
<td>maritime transportation system</td>
</tr>
<tr>
<td>NOAA</td>
<td>National Oceanic and Atmospheric Administration</td>
</tr>
<tr>
<td>OLE</td>
<td>other law enforcement</td>
</tr>
<tr>
<td>PPBE</td>
<td>Planning, Programming, Budgeting, and Execution</td>
</tr>
<tr>
<td>PPG</td>
<td>planning and programming guidance</td>
</tr>
<tr>
<td>PWCS</td>
<td>ports, waterways, and coastal security</td>
</tr>
<tr>
<td>SAR</td>
<td>search and rescue</td>
</tr>
<tr>
<td>SME</td>
<td>subject-matter expert</td>
</tr>
<tr>
<td>STRAP</td>
<td>strategic priority</td>
</tr>
<tr>
<td>TCO</td>
<td>transnational criminal organization</td>
</tr>
</tbody>
</table>
1. Introduction

The U.S. Coast Guard is undoubtedly a multimission force. Its rich array of authorities, such as law enforcement, safety, intelligence, and pollution response, enables often-complex operations in the Americas and around the world. Similarly, statutory missions highlight the diverse expectations of the U.S. government and the American people for their Coast Guard. These include search and rescue (SAR), drug interdiction (DI), and ice operations (IO). Accomplishing this work requires the Coast Guard to employ the capabilities resident in all the districts that together make up the Atlantic Area and Pacific Area.³

Having the right capabilities at the right time and place is foundational for enabling Coast Guard operations. The service relies on highly trained people, developed plans, smoothly running organizations, materiel assets, and a diverse infrastructure network to enable these capabilities. None of these aspects of capabilities is straightforward to develop or emplace. Capabilities take years to mature and must be maintained. Being prepared for hurricane response or interdicting goods along a smuggling route (for example) will have started with planning, training, and acquisition that occurred years or even decades prior to any particular Coast Guard mission day. Thus, a certain amount of foresight is needed to (realistically) best-guess the proper configuration of capabilities in advance of a particular need arising.

The Coast Guard’s primary mechanism for connecting anticipated needs or demands with capabilities is the Planning, Programming, Budgeting, and Execution (PPBE) process. The service uses plans to guide the application of budget toward investments in people, organizations, infrastructure, assets, and employing capabilities throughout its areas of responsibility. We describe this in more detail in Chapter 2, in which we also note that there are quite limited mechanisms for incorporating longer-term (beyond ten years out) outlooks into the decisionmaking that PPBE supports.

The Coast Guard also manages a strategic document library that serves to amplify near- and long-term considerations and concerns for the service. These strategies help the Coast Guard articulate certain or anticipated future changes in the operating environment or service itself that require consideration in plans and by external stakeholders (e.g., Congress). We touch on this in Chapter 2 as well and discuss the disconnect between this strategic library and the PPBE process.

The Coast Guard faces (not uniquely) the vast challenge of making trades between different priorities, including answering calls for present day-to-day needs while maintaining readiness for sudden disasters and keeping an eye on future changes. This is exacerbated by the large and

³ Geographic operating areas in the Coast Guard are divided into districts. The Coast Guard’s Deputy Commandant for Mission Support and Deputy Commandant for Operations (DCO) organizations also play important roles when it comes to the service’s capabilities, along with some offices that directly report to the Coast Guard commandant. See, for example, U.S. Coast Guard, undated b.
diverse set of statutory missions, limited budget, and strategic planning disconnects noted above. The service employs strategic foresight activities through a program known as Evergreen as one way to help mitigate the particular problem of linking slow-burning problems (e.g., changing climate) and problems over the horizon (e.g., possible future social or geopolitical changes) to actions that must be taken in the near term in order to prepare. In other words, Evergreen attempts to highlight areas of strategic urgency that require starting sometimes decades-long preparations sooner rather than later.

Ideally, the outputs of Evergreen strategic foresight activities would serve as actionable inputs to the PPBE process and as a bridge between the strategic library and PPBE. However, as we describe in Chapter 2, these connections are not typically strong. There are several reasons for this, some of which rest within the Evergreen approach—including the design and application of scenario-based analysis—and others that are more a symptom of the service’s strategic planning environment.

The primary objective of the research presented in this report was to propose a structured, repeatable scenario development process to support Evergreen strategic foresight activities facilitated by the Coast Guard Office of Emerging Policy (DCO-X) and to demonstrate its use for new Evergreen global planning scenarios focused on aspects of service readiness related to the workforce and materiel assets. Importantly, we selected the approach taken to generate these scenarios (described later in this chapter and report) in order to better posture Evergreen to meet the goal of providing actionable inputs to PPBE and better linking topics in the strategic library to decisions by and about (e.g., via Congress) the service. Before further outlining our work presented in this report, we provide a more thorough introduction of Evergreen.

**Evergreen and the Importance of Strategic Foresight for the Coast Guard**

Project Evergreen’s origins date back to 1998, when it was inaugurated as the Long View program. Its current name was adopted in 2002. (To avoid having to state “Long View and Evergreen” throughout the discussion, we use the term Evergreen to include the program during the Long View years.) Evergreen was modeled, in part, on the strategic planning group that worked for the Chief of Staff of the Air Force. Although Evergreen’s methods have been adapted over the years, the central approach relies on participatory discussion of qualitative scenarios representing futures 15 to 25 years hence. For example, a group of Coast Guard planners might be presented with four alternative futures representing change along two axes (say, climate and economic activity). After splitting into four teams, one for each alternative future, participants construct a mix of Coast Guard assets (e.g., cutters, helicopters) best suited for operations in each future. Then, participants compare results and examine how different proposals fare under conditions presented in the three alternative futures not originally examined when constructing the “ideal” asset mix (a basic test of robustness). Since 2002, there have been four iterations of Project Evergreen (designated Evergreen I through IV), each lasting four years, correlating to the
terms of recent Coast Guard commandants (CCGs). Evergreen V is underway at the time of this writing.

Evergreen’s most visible products have been a series of reports regarding Coast Guard strategy, goals, potential future challenges, and scenarios. Long View’s documentation articulates the need to shape Coast Guard strategy for the 2020 time frame with “the knowledge, agility and competencies that come from an integrated organizational structure, full-spectrum awareness, expansive partnerships and alliances, highly skilled and adaptable people, leading technology, and an unshakable sense of the Coast Guard’s purpose, mission and enduring values” (U.S. Coast Guard, 1999, p. 1-2). It linked these goals to the enduring missions of the service and ten specific strategic initiatives. Evergreen I’s capstone document (U.S. Coast Guard, 2005) identifies and analyzes a series of future scenarios, leveraging interviews and workshops. Moreover, it explains how to institutionalize Project Evergreen within the Coast Guard, ensuring that it contributed to strategic planning, budgeting, and other high-level decisionmaking. The corresponding Evergreen II document also describes the implications of diverse scenarios, together with a series of core action strategies (U.S. Coast Guard, 2009). These core action strategies related to such issues as advancing partnerships, developing polar mission capacity, improving technology acquisition, and enhancing global maritime governance. Evergreen III’s final document focuses on strategic needs and corresponding Project Evergreen actions (U.S. Coast Guard, 2013). Evergreen IV documentation built further on this, explicating a variety of strategic needs relating to technology, organizational alignment, the Coast Guard workforce, and resilience (U.S. Coast Guard, 2015d).

From the outset, the intent of Evergreen was to contribute to a more forward-thinking Coast Guard approach to future challenges. As a highly operational service with extensive demand for its missions, the Coast Guard often struggles with the “tyranny of the present.” Evergreen was intended to counter the Coast Guard’s focus on addressing short-term needs by exploring potential challenges that might arise decades into the future, as well as how they could be mitigated by anticipatory decisions or actions.

The physical and virtual environments in which the Coast Guard operates are not static. Demand for the Coast Guard’s services can change in volume or character in response to slowly evolving forces that shape physical, technological, economic, geopolitical and international security, policy and regulatory, and social environments. Certain events—environmental disasters, changes in political power, and health crises, for example—can also suddenly perturb the service’s day-to-day operations, sometimes for years (creating a new steady state). Furthermore, many of the Coast Guard’s current decisions and plans can have long-term impacts. Investments in personnel, infrastructure, and platforms usually take multiple years to come to fruition and typically endure for many decades. The people who will be leading the Coast Guard in the 2050s are already in uniform, and most of the physical assets that they will employ are either already supporting the service or will be completed within the next decade. Likewise,
strategic and policy choices that influence the culture and strengths of the Coast Guard could take many years to have the desired impact.

Although Evergreen has evolved in the past two decades, so too has the wider Coast Guard, in part because of external events. At the time of Long View’s creation in 1998, the Coast Guard had recently emerged from countering a series of mass migrations in the Caribbean. Just a few years after Long View’s inception, the terrorist attacks of September 11, 2001, had a profound impact on the service. The Coast Guard moved from the U.S. Department of Transportation to the newly created U.S. Department of Homeland Security (DHS). Both the national impetus and departmental priorities of countering terrorism contributed to demand for the Coast Guard to focus considerable effort in this area. However, a series of destabilizing human-caused and natural disasters—the 2004 coup d’état in Haiti, Hurricane Katrina in 2005, the 2010 earthquake in Haiti, the Deepwater Horizon oil spill in 2010, Hurricane Sandy in 2012, and Hurricanes Harvey, Irma, and Maria in 2017—also highlighted the Coast Guard’s key role in disaster response and recovery. The result is that, even as Evergreen has been aiming to look 20 or more years into the future, shifting and urgent demands on the Coast Guard have inhibited the service’s ability to focus on long-term plans.

Research Purpose, Approach, and Organization of This Report

As part of the fifth Evergreen agenda, the Homeland Security Operational Analysis Center (HSOAC) assisted DCO-X in building on these two decades of Evergreen history. In this report, we describe an updated approach for developing global planning scenarios and use it to formulate an initial set of scenarios for the Coast Guard to consider. Evergreen’s need for new scenarios is twofold: (1) The world and the service both continue to change, and scenarios should evolve in response to new decisionmaking needs and information about the future; and (2) Evergreen will benefit from an updated approach to strategic foresight (for reasons described in Chapter 2), and this requires starting with updated scenarios fit for use in a different methodological context (which is the focus of an accompanying volume to this report, Van Abel, Wilson, and Anania, unpublished). For the purposes of this research, we define global planning scenario as an alternative vision of the future multidimensional environment that incorporates information about uncertain trends and perturbations taking place across wide geographic areas and enables analysis of relevant trade-offs for decisionmaking.4 As described below and later in the report, we leveraged a variety of inputs to build qualitative scenarios that, although similar in some respects to prior Evergreens, are intended to avoid some of the problems with forecasting or traditional scenario planning that relies on detailed scenario narratives.

4 Although some phenomenon might drive change across the entire globe—or a wide swath of it—the impacts most important to the Coast Guard’s operating environment might be felt at a more regional or local level (e.g., in the form of a particular oil spill, drug transport corridor, or hurricane).
Approach and Methods

We grounded our proposed scenario development approach in two bodies of work with strong academic foundations and histories of use by a wide variety of practitioners that face similar challenges to those that the Coast Guard faces. The first set are frameworks devised in support of disaster resilience and climate adaptation planning (e.g., Arup International Development, 2015). In Chapter 3, we introduce the stressors-and-shocks framework as an approach for organizing and updating information about ongoing and future drivers of change that will affect operations and service internal considerations. We adapted this way of thinking from the resilience community of research and practice because it provides a way to curate and focus the highly dimensional and interconnected space of future change. For our purposes, it provided a convenient means of developing content for qualitative scenarios.

In Chapter 4, we illustrate those qualitative scenarios, which we built and shaped for use within the context of decisionmaking under deep uncertainty (DMDU) methods (Marchau et al., 2019). Briefly, DMDU methods are intended to address conditions of deep uncertainty, which are commonly defined as those in which (1) assigning probabilities to different futures or outcomes is difficult or impossible or (2) decisionmakers, key stakeholders, and analysts disagree substantially about the likelihood of different futures or which drivers are most significant. In general, trying to project conditions decades from today falls in the realm of deep-uncertainty analysis. Also in Chapter 4, we discuss DMDU and the application we propose and demonstrate for generating Evergreen global planning scenarios.

For specific information inputs to our scenarios, we relied on the sources and methods summarized in Table 1.1.

Table 1.1. Information Inputs to Evergreen Scenarios

<table>
<thead>
<tr>
<th>Input Source</th>
<th>Link to Scenarios</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coast Guard workshop with planning games</td>
<td>Populated stressors-and-shocks framework</td>
</tr>
<tr>
<td>Strategic foresight literature</td>
<td>Initial material for planning games used in workshop</td>
</tr>
<tr>
<td>Coast Guard survey</td>
<td>Initial material for planning games used in workshop</td>
</tr>
<tr>
<td>Prior Evergreen and Long View reports</td>
<td>Initial material for planning games used in workshop; analysis of past lessons that helped shape scenario content and structure</td>
</tr>
<tr>
<td>Evergreen logic model</td>
<td>Analysis of past lessons that helped shape scenario content and structure</td>
</tr>
<tr>
<td>Coast Guard interviews</td>
<td>Analysis of past lessons that helped shape scenario content and structure</td>
</tr>
<tr>
<td>Coast Guard strategy and planning documents and guidance</td>
<td>Analysis of strategic planning processes and needed inputs that helped shape scenario content and structure</td>
</tr>
<tr>
<td>HSOAC team internal SME reviews</td>
<td>Development of scenario families, scenario narratives (using stressors-and-shocks framework), and selected scenario-relevant shock narratives</td>
</tr>
</tbody>
</table>

NOTE: SME = subject-matter expert.
Organization of This Report

The remainder of this report walks through the primary steps we took to develop new Evergreen scenarios and an updated approach for generating them. First, we compiled lessons from past Evergreen activities (Chapter 2) to understand positive aspects of the Evergreen approach (including scenarios) that could be carried forward and areas that require improvement to produce better scenarios and, ultimately, more-effective Evergreen outputs. Second, we sought to understand the Coast Guard strategic planning landscape through PPBE and the strategic library (Chapter 2). This served to broadly identify key disconnects between over-the-horizon problems and near-term planning that Evergreen scenario-based analyses are intended to help mitigate. A key tenet of DMDU methods is that scenarios are developed in response to specific decision needs or questions rather than reacting to current events or hot topics or using a foresight approach to try to predict a “most likely” future for which to plan. Third, we curated a list of stressors and shocks (Chapter 3) that can be periodically updated and employed to organize structure content for scenarios in response to new, future decisionmaking needs. Fourth, we structured and narrated a series of scenarios intended to highlight trade-offs relevant to Coast Guard readiness (Chapter 4). We summarize our findings and conclusions in Chapter 5. An appendix provides a detailed description and results from an October 2018 Coast Guard workshop that informed aspects the scenario development. An accompanying volume (Van Abel, Wilson, and Anania, unpublished) describes one example of how to use Evergreen scenarios in a DMDU context and survey results as part of this broader approach.
2. Insights from Evergreen’s History and Relationship with Coast Guard Strategic Planning

Because of typically long lead times for capability investments, the Coast Guard must connect future problems and needs with shorter-term steps that can be realized in such processes as PPBE. Moving and preparing (e.g., through developing operating concepts and training personnel) to use capabilities can also require several years of advance notice. The nonstatic Coast Guard operating environment is susceptible to, among other things, changes in climate and environment, economics, geopolitical factors, and demographic and technological shifts. Thus, the status quo in capabilities and posture are unlikely to meet the diverse array of future demands on the service. The Coast Guard has employed Evergreen-facilitated, scenario-based analysis to build a bridge from the present to the future. As we describe in this chapter, there are two macro-level reasons this bridge has not functioned as well as it might with some future changes:

- There are shortcomings in historical Evergreen approaches and products, although several positive aspects that would be valuable if carried forward.
- The Coast Guard strategic planning landscape does not have robust mechanisms for connecting over-the-horizon planning considerations with near-term actions.

This chapter provides an introductory exploration of both issues. Although the report focuses on scenarios, we do not limit the discussion to this tool or approach for decision support. Scenarios have historically been an important aspect of Evergreen, but understanding the benefits and limitations within the broader context in which they are used helps motivate the stressors-and-shocks framework and scenarios described in Chapters 3 and 4, respectively. As we discuss, the importance of tailoring scenarios to support particular decisions is one of the major takeaways.

Lessons from Project Evergreen’s History

In the past two decades, Project Evergreen has varied in terms of its impact on the Coast Guard. The degree to which it has been able to influence Coast Guard plans, decisions, and strategies has depended heavily on, among other things, the extent of Coast Guard leadership’s engagement with Evergreen. We explore these issues, together with a host of other considerations, as we examine key lessons from Evergreen’s history.

We derived these lessons from documentary sources and structured discussions:

- **documents:** We reviewed written materials, such as published articles about Evergreen and Coast Guard foresight analysis, previous Evergreen documents, and the extensive Evergreen archives.
• **structured discussions:** We conducted nearly 25 structured discussions with myriad stakeholders, both within and external to the Coast Guard. All had participated in various capacities in Long View and Evergreen. These included civilian and military personnel who were former program office staff, senior Coast Guard leadership, Coast Guard experts who had regularly provided guidance to Evergreen (the core team), Evergreen facilitators and participants, planners and other potential consumers of Evergreen outputs, and other stakeholders. The structured discussions characterized individuals’ previous experiences with Evergreen and then elicited their views regarding the degree to which Evergreen is focusing on the right areas, engages the right people, and generates information and products that are actionable and useful. The discussions also included exploration of participants’ views regarding the overall strengths and weaknesses of Project Evergreen. We also asked participants to provide tangible examples of Evergreen’s impact on decisions, planning, and policy, together with instances in which it could have had a greater impact than it actually did.

To achieve several goals, we then aggregated and analyzed the results of our document review and structured discussions. First, we broadly characterized what Evergreen has been intended to do, what it has been doing, and the impact of its work in the past two decades. This included the development of a logic model to describe how Evergreen’s activities contribute to the service’s ultimate goals. We also reviewed aspects of the overall historical context in which the Coast Guard was operating during those decades, which inevitably influenced Evergreen and its impact. Next, we gathered lessons based on the experiences of Project Evergreen during that period, capturing key ways in which Evergreen has worked well, together with ways in which it could enhance the future quality and impact of its contributions. Finally, we explored actionable ways of implementing those lessons in the future.

**Logic Model for Evergreen**

A logic model offers a simplified visual representation of what a program or organization does. Although there are many variations on the structures of logic models, they typically connect the **inputs** (resources) that the program uses, the **activities** for which it uses those inputs, the direct **outputs** of those activities, the higher-level **outcomes** resulting from those outputs, and the ultimate **strategic goals** that the program seeks to achieve. Collectively, these items are the **elements** of the logic model.

Logic models are widely used in a variety of settings throughout government, the private sector, academia, and elsewhere. Logic models can help communicate what an organization does, ensure alignment of activities with goals, and aid in developing performance measures. They are largely analogous to strategy-to-task mappings, which are also used to characterize what organizations do and why. A variety of publications explain logic models and their usage (Broeckling, 2010; Greenfield, Williams, and Eiseman, 2006; Hatry, 2006; McLaughlin and Jordan, 1999; Newcomer, Hatry, and Wholey, 2015; Savitz, Matthews, and Weilant, 2017; Savitz, Willis, et al., 2015; W. K. Kellogg Foundation, 2004). For a prior HSOAC study, analysts developed a series of logic models describing the Coast Guard’s 11 statutory missions,
facilitating the identification of metrics to better characterize the Coast Guard’s impact (Savitz, Willis, et al., 2015).

Here, we use the logic model to explain Evergreen in greater detail and to understand the implications of some of the lessons identified—for example, whether there are sufficient types of the right kinds of inputs and whether inputs and outputs are connected. Figure 2.1 presents a logic model for Evergreen as it is currently intended to operate.

**Figure 2.1. Simplified Evergreen Logic Model**

The logic model is largely self-explanatory, but we would like to highlight a couple of aspects of it that will recur in discussion of lessons from Evergreen’s history. First, note that Evergreen’s outputs do not include predictions of the future. There is a high degree of inherent unpredictability regarding the future operating environment and specific events; Evergreen provides a way of exploring a variety of possible futures and finding ways in which to address potential risks or gaps, rather than a precise forecast. Second, as the outcomes indicate, Evergreen is intended to influence Coast Guard strategies, plans, policy decisions, budgets, acquisitions, investments, workforce management, and other ways in which the Coast Guard shapes its future. Although Evergreen adds value by inculcating habits of long-term thinking in the Coast Guard and by characterizing long-term Coast Guard issues for external audiences, much of its impact can be lost if it is not well integrated into Coast Guard processes for shaping the service’s future.

Table 2.1 lists the overall lessons that we derived from our analysis, together with the stages of the logic model to which they relate.

In this section, we discuss each of these lessons in turn. We wrap up each lesson discussion with implications for scenarios that help inform the approaches discussed in Chapters 3 and 4.
### Table 2.1. Lessons from Evergreen’s History

<table>
<thead>
<tr>
<th>Lesson</th>
<th>Relevant Stage of the Logic Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Having limited resources has constrained Evergreen’s contributions.</td>
<td>Inputs  Activities  Outputs Outcomes</td>
</tr>
<tr>
<td>Evergreen’s outputs have been generally well regarded, with some caveats.</td>
<td>x</td>
</tr>
<tr>
<td>Evergreen outputs could be timelier.</td>
<td></td>
</tr>
<tr>
<td>Evergreen’s impact has been a strong function of senior leadership engagement.</td>
<td>x x x</td>
</tr>
<tr>
<td>Evergreen could have a greater impact if its outputs were better integrated into Coast Guard processes.</td>
<td>x</td>
</tr>
<tr>
<td>Cultural and institutional factors have inhibited Evergreen’s impact.</td>
<td>x x</td>
</tr>
<tr>
<td>Evergreen’s impact was not always broadly recognized within the Coast Guard.</td>
<td>x</td>
</tr>
</tbody>
</table>

**Having Limited Resources Has Constrained Evergreen’s Contributions**

Evergreen has generally been run with very limited resources: a couple of Coast Guard officers (typically an O-4 and an O-5), a modicum of funding for contractor support, and a mandate. We did not perform a rigorous staffing assessment, but staffing appears to be thin, according to inputs from multiple interviewees; most suggested that larger numbers of personnel were needed, and a couple mentioned the need for contract-management expertise and logistics support. Former Evergreen personnel indicated that they were unable to keep on top of the many demands on their time. To connect this back to the logic model, tightly constrained inputs limited the scope of activities, attenuating Evergreen’s downstream impact.

Adding civilians to the Evergreen team could help ensure continuity, taking into account that officers turn over every couple of years. Moreover, increasing the seniority of Evergreen leadership to an O-6 and adding more-junior personnel could help give Evergreen the institutional heft and critical mass that it needs to have a greater impact. In addition, having a variety of personnel with greater experience in the areas that Evergreen seeks to influence—such as strategy development, long-term planning, budgeting, and acquisition—would likely strengthen its ability to shape those areas. Moreover, as noted previously, contract-management expertise and logistics support would enable other Evergreen personnel to focus on doing analysis and having impact.

Some iterations of Evergreen had core teams, which was a group of civilian and military experts that helped Evergreen personnel develop scenarios and analyses. The group’s diverse mix of technical and operational expertise helped Evergreen to identify trends, formulate strategies, and identify capability gaps, as well as to promulgate the insights generated through the Evergreen process. In some cases, core team members were able to incorporate Evergreen material into their own planning activities. Reinstating the core team or a similar group of
advisers could provide Evergreen with valuable expertise to produce more-valuable insights and the leverage that it needs to ensure that the program has an impact.

Obtaining more resources in a budget-constrained environment is challenging. Having a structured, repeatable process for scenario development that requires updating rather than starting from scratch can help employ limited resources more effectively, in addition to many other potential benefits.5

**Evergreen’s Outputs Were Generally Well Regarded, with Some Caveats**

Many people who had interacted with Evergreen over the years commented positively on the value of its outputs, in the form of the tangible documents that Evergreen produces. One striking finding was that Evergreen’s products were sometimes used outside the Coast Guard; for example, the Chief of Naval Operations’ Strategic Studies Group drew on Evergreen scenarios and analyses in its own research, as did the State Department and the Royal New Zealand Coastguard. Overall, interviewees thought that Evergreen was valuable for a variety of reasons:

- focuses enterprise-wide and captures input from a diverse group that has a breadth of expertise6
- employs relatively simple, but rigorous, approaches
- provides a unique opportunity to examine and probe new ideas and operational constructs, or to question the status quo, in a structured and safe setting
- forces participants to confront hard choices in terms of how to distribute limited resources across diverse geographic and mission demands
- helps substantiate the need for policy changes or resource shifts in a more tangible way than senior leadership asserting that certain changes are needed
- enables participants to gain valuable insights on trends, shocks, and strategies for coping with potential future maritime environments.

Regarding this last point, interviewees overwhelmingly stated that they valued their participation in Evergreen events and that this exposure permanently broadened their perspectives on, and appreciation for, longer-term issues that might affect the Coast Guard. Exposure to specific trends and their effects on the maritime environment gave them a greater awareness of the context of Coast Guard operations and made them more attuned to potential influences, an approach they could apply in subsequent positions and leadership roles. In addition, the methods and thought processes provided them tools to avoid getting boxed into a short-term mind-set and to think more strategically and consider uncertainty and risk regardless of their subsequent positions. Interviewees also noted a couple of instances in which Evergreen

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5 For example, being able to support adaptive decisions, enabling easier comparison between Evergreen events, or amplifying recognition of Evergreen because of its association with a familiar approach.

6 Indeed, research on innovative organizations recommends utilizing formal or informal cross-functional teams that employ a system view of the enterprise to break down barriers created by siloed functional organizations or mind-sets for creative problem-solving and innovation (Kanter, 1997; Knopman et al., 2003; Kotter, 1996).
has provided a framework for thinking through shocks (what ifs), for which simply walking through the response options was a form of contingency planning that ultimately improved Coast Guard response. People who were involved in Long View and Evergreen I indicated that they had been better able to address challenges following September 11, 2001, and Hurricane Katrina because of the habits of thought that they had gained from their experiences. For those in planning jobs, the insights gleaned during the process provided useful information for human capital planning, budget planning, intelligence planning, and strategy development. These effects were not limited to the people who participated but also influenced others with whom they worked. All of these influences help to counter the short-term focus that is often imposed by the Coast Guard’s high operational tempo, leaving relatively little time for training and reflection.

However, there were mixed reviews of individual scenarios that Evergreen had developed. In some cases, Evergreen scenarios were not perceived as forcing workshop participants to confront the types of hard choices that would have stimulated deep, creative thinking. There were also perceptions that some scenarios were too tactical in nature and had limited value with respect to long-term planning. Moreover, some of the products that Evergreen generated—so-called weather reports that presented what-if analyses during the course of Evergreen IV—were not perceived as having been well developed or having been particularly valuable to others in the Coast Guard.

There is much to draw on here for future Evergreen scenarios. There seems to be a lot of perceived benefit from focusing on longer-term uncertainties. However, further motivating scenarios based on decisions at hand or to stress-test specific strategies or capabilities will help increase Evergreen’s benefits. Although the intent of previous Evergreen scenarios appears in line with this, borrowing principles from existing structured decision analytic approaches will help realize this aim in practice.

**Evergreen Outputs Could Be Timelier**

There were also issues with respect to the timeliness of the main reports that Evergreen generated, which were published at the conclusion of each four-year iteration of Evergreen. Although those reports were valued for documenting what had been discussed and sharing that information with a wider audience, the long time lag diminished interest in the topic and, ultimately, the impact of these outputs. It is challenging enough to get Coast Guard personnel to focus on multidecade time horizons when faced with a relentlessly high operational tempo; publishing the results of Evergreen workshops and analyses multiple years after they had taken place resulted in a loss of momentum and a degree of disinterest. Given turnover, the people who had been engaged with Evergreen through elicitation or workshops were often in different roles by the time Evergreen published its reports. The fact that senior leadership knew that Evergreen’s reports would not appear until four years in the future—in time for the next CCG—might have contributed to disengagement.
As a result, there was a strong interest in timelier intermediate outputs. For example, it would be valuable to provide workshop summaries within days or weeks of the workshop’s conclusion, capturing the insights generated and sustaining momentum. Shifting Evergreen’s orientation to focus on annual or semiannual, rather than quadrennial, products would likely make the project more relevant and increase the impact of its work. Evergreen’s insights could be continually incorporated into various processes, rather than being introduced every four years into processes whose personnel might not recall how the processes had been used.

Further structuring the Evergreen scenario development process could help meet shorter timelines (at least for initial products) for two reasons. First, there could be less time spent on the front end of analyses in developing completely new scenarios. Second, some of the written material (and, perhaps eventually, quantitative supporting data) could be taken off the shelf when writing new documentation. Of course, there would need to be some new material each time to ensure that the scenarios are sufficiently updated with worldwide and service developments and that the scenarios meet new analytic needs.

**Evergreen’s Impact Has Been a Strong Function of Senior Leadership Engagement**

Many of the people with whom we spoke emphasized the degree to which Evergreen’s impact had varied as a strong function of the degree of support provided by senior leadership at any given time. Senior leaders who perceived Evergreen as having considerable value, and who communicated that perception to the wider Coast Guard, enabled Evergreen to have a greater impact than it had when senior leadership was less engaged. Senior leadership played a particularly strong role in terms of fostering participation in Evergreen workshops. This contributed to the success of those workshops because people with appropriate levels and diverse types of experience were involved. Their knowledge helped stimulate creative ideas that were grounded in their collective expertise, more so than when senior leadership was less engaged and did not press for their participation. Moreover, their involvement also contributed to buy-in by the same personnel after the workshops concluded. To put this in logic-model terms, senior leadership’s emphasis on the importance of Evergreen activities and demonstrated engagement with Evergreen outputs helped to increase the project’s ability to fulfill outcomes.

Scenarios themselves cannot address the implications of uneven senior leadership engagement with Evergreen. However, scenarios can be tailored toward key issues with which senior leaders are concerned. Relevance to senior leadership has historically been important to Evergreen. Making clear connections with important strategic initiatives or adding richness to senior leader discussions of important future issues is more likely when scenarios are tailored to these types of specific purposes. Using a scenario development approach that explicitly takes this into account is helpful.
Evergreen Could Have a Greater Impact If Its Outputs Were Better Integrated into Coast Guard Processes

Project Evergreen has not had as great an impact on the Coast Guard as might be desired. A key reason for this appears to be a long-standing disconnect between Evergreen and the processes that it aims to influence. Evergreen has not been designed as a part of those processes, with an explicit role in helping to shape strategies, plans, and budgets, but rather has operated largely as a stand-alone entity. Now we connect this back to the logic model: Evergreen’s activities and outputs have stood apart from those of the wider Coast Guard, diminishing the ability of those outputs to influence outcomes. Although its ideas and analyses have indirectly stimulated the thinking of individuals and teams making decisions, Evergreen’s impact has been circumscribed in the absence of formal integration into Coast Guard processes. This is not to say that Evergreen’s activities should be integrated into current processes; there are benefits to the relative independence of the existing process. Rather, the production cycles of Evergreen outputs should align with major decisionmaking processes such that those outputs can better inform the decisions in question (that is, not just in time or too late). Better interfaces between Evergreen and those processes need to be developed and made explicit via defined processes.

This is not a new finding; it was documented in Long View and Evergreen lessons learned from 2003 and 2007. A key question is why it has not been addressed. At least part of the reason is that the Coast Guard has broader issues with long-term planning, which we discuss under the rubric of cultural and institutional issues in the next section.

Once again, understanding the decision support need is important for making good scenarios. This particular lesson suggests that coordinating more tightly (as possible) with some key offices and planners at various levels within the service could be important for scenario development. Furthermore, such details as the time frame explored within a scenario, the pace of change, and the types of assumptions included might take into consideration specific types of information that planning or other activities are using for their own inputs. It is important for Evergreen to remain unique in order to provide valuable new perspectives; however, scenarios can be further tailored to ensure relevant Evergreen analytic outputs.

Cultural and Institutional Factors Have Inhibited Evergreen’s Impact

Interviewees mentioned several aspects of Coast Guard culture and institutions that limited Coast Guard receptivity to, and implementation of, Evergreen findings. In logic-model terms, because of cultural and institutional factors, Evergreen’s outputs did not always achieve the desired degree of impact in terms of outcomes. These factors include

- **high operational tempo**: The urgent focus on current operations (exacerbated by periodic crisis) serves as a perennial distraction from the need to envision long-term futures, then develop strategies and plans around them. The result is that Evergreen’s long-term thinking often gets overlooked amid the need to address current and near-term concerns.
• **an anticipated lack of sufficient resources to implement plans:** The Coast Guard’s ability to develop long-term plans is inhibited by the widespread perception that the service will not have the resources to implement them. Although the Coast Guard has developed a variety of strategies in the past decade (e.g., U.S. Coast Guard, 2015b; U.S. Coast Guard, 2016a; U.S. Coast Guard, 2019), the fact that the Coast Guard is consistently struggling to fund short-term needs—and the perception that this is unlikely to change—dissuades extensive planning for possible long-term future contexts.

• **organizational inertia:** Like many organizations, the Coast Guard is most comfortable continuing to operate in the way that it has in the past and anticipating only limited changes to the current state of affairs. Implementing strategies for the long term requires a comprehensive, sustained approach to change management, which the Coast Guard currently lacks.

• **desire for consensus:** The Coast Guard values consensus and the lack thereof can encumber an initiative, even when many recognize that it has merit and should be implemented. This suggests that some efforts need to be made to build additional consensus and buy-in around the concept and utility of the program to the extent that this is possible.

• **departmental focus issues:** The Coast Guard’s diverse portfolio of missions has always created priority-related tensions with the department to which it belongs, regardless of which department that is: Some of its varied missions will always lie outside the focus areas of that department. At present, Coast Guard long-term planning with respect to several of its missions—such as aids to navigation (ATON) and waterway management, SAR, living marine resources (LMR), and other law enforcement (OLE)—are inhibited by the fact that these are not high priorities for DHS. The result is that development and implementation of plans for these missions face additional hurdles beyond those faced by missions that are more central to DHS, and Evergreen analyses regarding these missions are less likely to have impact.

These cultural and institutional challenges are not readily subject to change. However, knowledge of their existence can contribute to long-term, sustained efforts to redress some of the issues that they create in implementing Evergreen findings. For example, Evergreen analyses that relate to missions outside of DHS’s usual purview likely require additional championship. (They can also be particularly important precisely because these are areas that might otherwise be overlooked.) Senior leaders can aim to shape the culture through sustained efforts to communicate that long-term thinking is a priority, by demonstrably valuing such thinking (thinking done by Evergreen and others), and by encouraging personnel to think beyond immediate resource constraints or present circumstances.

Only so much work on scenarios can be done in consideration of this group of issues. However, scenarios can help link the future to the present and can be designed (as described in Chapter 4) to facilitate the discussion of trade-offs, which is often easier to build consensus around rather than arriving at one “right” decision. Scenarios can also acknowledge important tensions between the “now” and the future, as well as between day-to-day needs and

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7 As distinct from individual products or analytic conclusions—these are valuable in their relative independence.
contingencies. In Chapter 3, we describe an approach that the resilience community has employed to foster inclusion of different types of demands in scenario-based analyses and discussions.

**Evergreen’s Impact Was Not Always Broadly Recognized Within the Coast Guard**

Many people who had participated in Evergreen indicated that its impact was not always broadly recognized within the Coast Guard. In logic-model terms, its successes with respect to outcomes were sometimes invisible or known only to a few people. Partly, this stems from the fact that its effects were generally the indirect result of ideas generated in Evergreen workshops or analyses having been gradually embraced and then implemented, without explicit attribution. In addition, some of Evergreen’s ideas have taken many years for the Coast Guard to digest, by which time Evergreen’s contributions might be unclear or unknown. However, we have captured specific impacts of Evergreen, based on documentary sources and discussions with key people. Here, we list some that were either acknowledged by multiple independent sources or involved an explicitly identified mechanism of impact:

- Long View contributed to making the Coast Guard a more geographically based organization, reflecting assessments that Coast Guard resources needed to be more responsive to the sectors’ and districts’ needs.
- Long View contributed to the Coast Guard’s embrace of the concept of maritime domain awareness, demonstrating that it was a robust operational need for diverse scenarios.
- Long View explored how the Coast Guard could address terrorist threats as well as massive hurricanes. Multiple people indicated that the Coast Guard was better prepared to respond to the 9/11 attack because those who had participated in the process had already walked through terrorist scenarios and therefore could more efficiently execute these contingency plans when the attack occurred; there were similar comments with respect to Hurricane Katrina.
- One shortfall of Long View’s exploration of terrorism is that terrorist threats were treated as temporary shocks rather than as protracted events that would substantially change strategy.
- Long View and Evergreen provided some of the analytical foundation for building polar icebreakers, ultimately contributing to sustained Coast Guard efforts to garner investment for this purpose.
- *The U.S. Coast Guard Strategy for Maritime Safety, Security, and Stewardship* (U.S. Coast Guard, 2007) explicitly states that it was informed by Evergreen.
- A 2012 Evergreen workshop on Cuba contributed to Coast Guard engagement with the Cuban border patrol on SAR, oil spill response, and border security. When President Barack Obama proposed normalizing relations with Cuba in 2014, these partnerships enabled the Coast Guard to have a leadership role in the new relationship.
There is disagreement about the extent to which Evergreen influenced the Coast Guard’s Arctic Strategic Outlook (U.S. Coast Guard, 2019), Western Hemisphere Strategy (U.S. Coast Guard, 2014c), Cyber Strategy (U.S. Coast Guard, 2015b), and Human Capital Strategy (U.S. Coast Guard, 2016a). Some stakeholders assert that Evergreen raised awareness of key issues in these areas, while others indicated that the strategies were composed by personnel who were only tangentially aware of Evergreen’s work.

One way in which structured scenario design can help here is to take into account the anticipated impact of the analysis. Not only will this aid in ensuring that scenario-based analysis will have impact; it will also help keep track of whether the (intended, at least) impact is achieved by defining the expectation (not the result or conclusion) of the scenario-based analysis at the outset.

A Brief Overview of Coast Guard Planning, Programming, Budgeting, and Execution and the Strategic Library

The Coast Guard employs several mechanisms to support strategy, planning, and decisionmaking. We cannot cover all the forms and intricacies of Coast Guard strategy and plans; however, in this work, we reviewed two major, somewhat related bodies of Coast Guard work:

- strategy-focused products within the PPBE process—specifically, key documents that fall within the planning step of this process
- the Coast Guard Strategic Library, which is a living suite of documents that reflect Coast Guard and CCG areas of emphasis for long-term strategy and planning.

In the sections that follow, we provide a high-level summary of these two bodies of Coast Guard work and how they relate to each other in 2019. Overall, PPBE focuses on concrete actions, whereas the strategic library is very conceptual. Both serve as good examples of focal points within the Coast Guard that Evergreen could support with scenario-based analysis. It is worthwhile discussing them both in brief here for two reasons. First, they outline two different scales and types of decisionmaking that can shape Evergreen scenario content. This helps motivate a structured, yet flexible, approach to scenario development that emphasizes stakeholder engagement. Second, we describe a disconnect that appears to exist between long-range, conceptual strategies and near-term plans focused on budgets. The success of Evergreen and its scenarios is limited by this disconnect. It is also possible that developing scenarios that enable mapping from the present to the future—and even more fundamentally explicitly identify mission-relevant types of change—can help provide one mechanism for starting to bridge this type of divide.
Planning, Programming, Budgeting, and Execution

The PPBE process is a common construct used in the U.S. Department of Defense (DoD) and DHS to translate short- to mid-term strategic priorities (STRAPs) to specific actions in the development and execution of plans and budgets. Specifically, it is designed to identify Future Years Homeland Security Program (FYHSP) (in the case of the Coast Guard and DHS) or Future Years Defense Program (for other military services) priorities for spending that reflects strategic goals (CCG, 2016). As a result, it includes different types of plans and in within the planning phase, summarized in Figure 2.2. Some of these plans and inputs consider relatively short time horizons (months to years), whereas others lay out steps that will take several years to implement. The FYHSP includes funding allocations for five years and is updated annually during the planning phase of the process.

Figure 2.2. Simplified Overview of the Planning, Programming, Budgeting, and Execution Process in the Coast Guard


Here, we briefly add some detail about the planning phase and some of the plans therein to ultimately offer some options for specific contributions that Evergreen could make to the front end of the PPBE process. The assistant commandant for resources owns the process, and DCO
and DCMS are responsible for initiating activities under the planning phase. The planning phase kicks off with the annual strategic review conducted by DCO. This review is informed by several inputs, including the following:

- Coast Guard Atlantic Area and Pacific Area IPLs, which communicate future regional needs identified through an iterative process that takes into account needs identified by districts and the sectors within them.
- Strategic guidance derived from U.S. national, DHS, and Coast Guard strategies, as well as guidance from CCG.
- DCO program plans, which are documents developed to help support DHS’s efforts to meet Government Performance and Results Act Modernization Act of 2010 (GPRAMA) (Pub. L. 111-352, 2011) requirements for each federal agency to create a strategic plan (updated every four years), an annual performance plan, and an annual performance report. GPRAMA-required documents are updated annually and assess the upcoming year with a five-year outlook. Coast Guard program plans present service strategic initiatives and explain the challenges, threats, and opportunities that have been assessed to have the likeliest and greatest impact on Coast Guard responsibilities. These strategic plans can also detail follow-on actions and metric use to assess performance (DCO, 2018).
- Input from DCO-81 on relevant findings from various Coast Guard studies, assessments (including mission analysis reports [MARs] and Evergreen assessments), and program evaluations.

DCO’s focus in the annual strategic review is to identify and validate strategic risks, gaps, and opportunities. The output of this review informs the STRAP document, developed by DCO and DCMS, which informs the initial planning meeting between the IRB and the CCG, along with current-year base budget reviews, projected service needs, and the top-line FYHSP (all developed by the assistant commandant for resources and the resource management offices).

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9 Personal communication with Coast Guard SMEs on March 26, 2019.
10 Because the Coast Guard itself is not a federal agency but is part of DHS, DHS is the agency responsible for GPRAMA and nothing at the federal level explicitly requires the Coast Guard to provide these plans. In practice, the Coast Guard appears to follow the guidelines laid out in GPRAMA, however, in support of DHS planning activities mandated by law.
11 Although DCO-81’s input is not formally called out in Coast Guard Commandant Instruction (COMDTINST) 7100.1 (CCG, 2016), which governs the PPBE process, DCO’s description of inputs to and outputs from key activities of the PPBE process highlights DCO-81’s role in the annual strategic review.

According to an undated draft of COMDTINST 5280.1B, “Mission Analysis Policy,”

A MAR identifies and documents the major current and future gaps or performance limitations of a Coast Guard mission system. MARs provide an in-depth assessment of how the combination of ongoing and forecasted environmental, economic, and operational trends combined with internal Service factors will impact future mission performance.

12 The IRB has oversight over the PPBE process and consists of senior flag officers. For more information on the IRB, see CCG, 2016.
This meeting is the strategic underpinning of the entire PPBE process. Informed by the outcomes of this meeting, the vice commandant of the Coast Guard issues the FYHSP PPG, which includes outcomes, guidance and direction from the initial planning meeting of the IRB and CCG, including establishment of budget build boundary conditions, and development of initiatives for the FYHSP period. The PPG also summarizes fiscal priorities and provides specific direction for resource allocation. (CCG, 2016, p. 2)

Once the PPG is issued, the process moves into the **programming phase**. During this phase, the service evaluates ways to meet mission performance standards and achieve strategic objectives. The outcome of these evaluations informs the resource allocation plan, which is provided to DHS for approval. Once DHS provides a decision on the resource allocation plan, the **budgeting phase** begins, which entails preparing a budget and submitting it to the Office of Management and Budget. The **execution phase** begins at the start of the fiscal year (FY) and consists of monitoring activities to ensure the proper execution of funding disbursement.

The PPBE process, as outlined in COMDTINST 7100.1 (CCG, 2016), does not appear to have a formal requirement to consider future trends and changes in the operating environment past the five-year planning cycle. However, as highlighted above, there appears to be some consideration of longer time horizons in practice. During the annual strategic review, DCO-81 provides key inputs on relevant findings from Coast Guard studies and assessments, such as its MARs and Evergreen assessments. In addition to Evergreen assessments produced as a result of strategic foresight activities, MARs consider “future gaps” and “future mission performance” (although future is not defined with any timeline) (CCG, 1995).

By definition, we would expect that the activities in the planning phase of the PPBE process would consider various strategy documents and strategic assessments—that is, in fact, what Coast Guard guidance indicates. According to our SME interviews, however, most of the strategies and strategy-like documents do not seem to be used to inform the PPBE process in any systematic way. However, some products of the PPBE process might themselves be considered strategic documents, as described in the next section.

**The Coast Guard Strategic Library**

The Coast Guard strategic library includes documents called *strategies*, *strategic intents*, *strategic plans*, *strategic outlooks*, and *strategic blueprints*. The granularity levels of these strategies vary widely; some documents list pages of specific tasks, while others remain at a very high level.

According to interviews with Coast Guard SMEs, the strategies listed in Table 2.2 are intended to communicate, to internal and external audiences, Coast Guard priorities, emerging issues, and links to other U.S. government organizations and initiatives.\(^{13}\) In some cases, these

\(^{13}\) Personal communication with Coast Guard SMEs on September 11, 2018, and September 12, 2018.
strategy documents can also be used to help fulfill DHS or other requirements to associate funding with strategy.

Table 2.2. Coast Guard Strategies and Strategy-Like Documents

<table>
<thead>
<tr>
<th>Type</th>
<th>Document</th>
<th>Date Published</th>
<th>Citation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary strategic document</td>
<td>United States Coast Guard Commandant’s Strategic Intent 2015–2019</td>
<td>c. 2015</td>
<td>U.S. Coast Guard, 2015a</td>
</tr>
<tr>
<td></td>
<td>Commandant’s Direction 2014</td>
<td>May 30, 2014</td>
<td>U.S. Coast Guard, 2014b</td>
</tr>
<tr>
<td>Other Coast Guard strategy</td>
<td>United States Coast Guard Human Capital Strategy</td>
<td>January 2016</td>
<td>U.S. Coast Guard, 2016a</td>
</tr>
<tr>
<td></td>
<td>United States Coast Guard Cyber Strategy</td>
<td>June 2015</td>
<td>U.S. Coast Guard, 2015b</td>
</tr>
<tr>
<td></td>
<td>United States Coast Guard Western Hemisphere Strategy</td>
<td>September 2014</td>
<td>U.S. Coast Guard, 2014c</td>
</tr>
<tr>
<td></td>
<td>United States Coast Guard Arctic Strategic Outlook</td>
<td>April 2019</td>
<td>U.S. Coast Guard, 2019</td>
</tr>
<tr>
<td></td>
<td>DHS Intelligence Enterprise Strategic Plan</td>
<td>January 2006</td>
<td>DHS, 2006</td>
</tr>
<tr>
<td></td>
<td>Ocean Guardian</td>
<td>c. 2014</td>
<td>U.S. Coast Guard, 2014a</td>
</tr>
<tr>
<td></td>
<td>United States Coast Guard Maritime Commerce Strategic Outlook</td>
<td>October 2018</td>
<td>U.S. Coast Guard, 2018a</td>
</tr>
<tr>
<td></td>
<td>United States Coast Guard Pacific Area Strategic Intent, Fiscal Years 2015–2019</td>
<td>January 2016</td>
<td>U.S. Coast Guard, 2016b</td>
</tr>
<tr>
<td></td>
<td>Great Lakes Maritime Strategy: A Strategic Framework for the U.S. Coast Guard on the Great Lakes</td>
<td>September 2017</td>
<td>U.S. Coast Guard, 2017</td>
</tr>
<tr>
<td></td>
<td>“Telecommunications Strategy (TCS)”</td>
<td>May 2013</td>
<td>CCG, 2013</td>
</tr>
<tr>
<td>Joint strategy with another component, another agency, or a foreign counterpart</td>
<td>A Cooperative Strategy for 21st Century Seapower</td>
<td>March 2015</td>
<td>Department of the Navy, 2015</td>
</tr>
<tr>
<td></td>
<td>Cooperative Maritime Strategy</td>
<td>February 2013</td>
<td>U.S. Coast Guard and NOAA, 2013</td>
</tr>
</tbody>
</table>
We were able to identify clear processes or guidance for initiating, writing, and using many of the documents that contribute to the planning phase of PPBE. However, for the strategies that appear in this library, we could not. Interviews with Coast Guard experts with proximity to these strategy documents suggest that—at best—development can follow historical practices that are not formally or widely documented. Although many of these strategies have either documented or understood timelines for updates, there are few indications on how these should be formally employed in Coast Guard planning processes. In practice, it appears that various Coast Guard offices might elect to include insights from the strategic library in their processes as they see fit. According to interviews and an all–Coast Guard survey (DCO-X, 2018), individual Coast Guard members use these strategies for personal educational purposes, if they are aware of them at all. Externally, these strategies appear to be a tool for communicating with Congress and DoD, for example.

In general, these strategies appear quite siloed from the PPBE process; unlike PPBE, these documents typically do not have actions or tasks associated with them. If they do have implementation plans, the progress is not tracked through any sort of formal method.\footnote{In \textit{Framework for Strategic Mission Management Enterprise Risk Stewardship and Internal Controls} (DCO, 2018), Coast Guard strategies are listed as an input to the Annual Strategic Review of the PPBE process but do not appear to directly inform any other plans use in the PPBE process.}

The disconnect between the strategic library and the PPBE process points to an overall structural dysfunction in how the Coast Guard thinks about strategy and long-term planning. Long-term strategy development is important for an organization because it provides both internal and external guidance on organizational goals and priorities. All activity, planning, and acquisition should be made within the context of organizational strategy; this ensures that all organizational activity is focused and in alignment. The lack of connection between strategies and the PPBE process suggests that the Coast Guard’s organizational alignment to an overarching strategy is lacking. The Coast Guard is not alone in this—developing a well-structured process for strategy making is hard, and many organizations struggle to do it right.
3. A Framework for Organizing Mission-Relevant Drivers of Change

A fundamental—and, arguably, the greatest—difficulty in designing decision-relevant scenarios is determining what factors of change to include and how these can be most effectively represented. We first identified an example decision context to focus our curation of a list of mission-relevant drivers of change. We then adapted a framework for identifying and organizing these drivers from some recent work on resilience. In this chapter, we introduce the decision context, describe this framework, and provide an initial list of driver types. This includes the articulation of long-term trends (stressors) and short-term perturbations (shocks) to populate the framework. In the next chapter, we focus on selecting the drivers of change from this list that are most relevant to a particular decision context, then using them to construct scenarios based on the content within the framework.

A Decision Context for Scenarios

HSOAC was tasked to develop scenarios at a conceptual, strategic decisionmaking level to provide a starting point for a wide possible set of applications. Thus, we turned to guidance in Coast Guard Strategic Plan: 2018–2022 (U.S. Coast Guard, 2018b) to scope our choices of stressors and shocks (described next) to include in this initial global planning scenario development. The strategic plan discusses the service’s STRAPs and links two categories of efforts to enterprise management (Figure 3.1). These priorities provide important evidence regarding the service’s long-term goals and point to the types of decisions the Coast Guard might make in the near term to achieve these goals. The stressors and shocks we articulate here were filtered (in part) based on priorities outlined in the strategic plan, which provided a suitable starting point for defining scenario families as described in Chapter 4.

We focused the content of our stressors-and-shocks framework and the resulting scenarios (discussed in Chapter 4) on the first priority listed in the strategic plan: Maximize readiness today and tomorrow. We chose to focus on this priority for two reasons. First, the plan indicates that this is the most important priority. Second, this priority is inherently forward-leaning in its specific articulation of a link to the future, which increases the relevance of scenarios designed to look 20 to 30 years ahead. Further, the types of solutions that might be considered within readiness initiatives (e.g., acquisition, plans for personnel) are inherently “sticky,” in that they have long-term implications. To reduce the scope of our analysis, we focused on the first two objectives of the readiness priority:

- Cultivate the mission-ready total workforce.
- Modernize assets, infrastructure, and mission platform.
Now, we turn to the central concept behind the stressors-and-shocks framework.

The Stressors-and-Shocks Framework

The Coast Guard has a rich history of using *drivers of change* as an approach to identify what forces might shape operations in the future.\(^{15}\) For example, this approach has been used in previous Evergreen planning cycles, *Coast Guard Strategic Plan: 2018–2022* (U.S. Coast Guard, 2018b), *United States Coast Guard Western Hemisphere Strategy* (U.S. Coast Guard, 2014c), *United States Coast Guard Security Sector Assistance Strategy* (U.S. Coast Guard, 2015c), and *United States Coast Guard Maritime Commerce Strategic Outlook* (U.S. Coast Guard, 2018a). The drivers-of-change approach compiles potential drivers of change and then seeks to identify causal relationships between drivers and (generally significant) transformations in the operating environment.

We built on the Coast Guard’s rich history of using drivers as an approach for compiling and sorting information about what will shape operations in the future. First, we conducted a rigorous review, driven by subject-matter expertise in our team, of the application of drivers-of-change

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\(^{15}\) The general idea for organizing concepts of change around drivers is commonly used in a variety of disciplines, including the applied and natural sciences (see, for example, Bulleri and Chapman, 2010, and Cloern and Jassby, 2012), business strategy and corporate consulting (see, for example, Kirsch, Chelliah, and Parry, 2011, and Arup Foresight, 2018), and security analysis (see, for example, U.S. Marine Corps, 2015, and Department of the Air Force, 2015).
approaches in other academic disciplines, business areas, and government offices. This review enabled the conceptual outline for the stressors-and-shocks framework, offered a starting point for a list of relevant drivers and types of operating environment impacts, and confirmed a lack of clearly more-suitable alternative frameworks. Second, the team tested the initial stressors-and-shocks framework using two games at an October 2018 workshop (see the appendix) that enabled Coast Guard members to interact with and react to the concepts we put forward. Results from these games enabled us to better focus the framework to meet Coast Guard needs while still ensuring that the central concepts therein provided opportunities for independent review (e.g., based on academic and other government and business research) of key drivers of change. The games—along with subsequent Coast Guard interviews and a Coast Guard survey (DCO-X, 2018; described in Van Abel, Wilson, and Anania, unpublished)—also helped us gather material about specific stressors and shocks that populates the framework and derives Evergreen global planning scenarios.

The stressors-and-shocks framework offers a conceptual approach for thinking through which drivers are most relevant for potential impacts on Coast Guard missions. This provides the structure to review, update, and highlight long-term, slow-burning global and regional trends (stressors) and sudden, large-scale disruptions (shocks) for potential impact on the demand for Coast Guard resources and the Coast Guard’s ability to execute missions. Importantly, this framework is not intended for one-time use. The world and the Coast Guard are continuously evolving; this framework provides the structure and continuity for regular examination of existing and emerging trends and disruptions that will or could affect the operating environment. As such, the framework is a theoretical launching point for deriving Evergreen global planning scenarios with consistent underpinnings that can change as new problems and key decision points emerge.

The framework we propose involves a three-step approach: (1) Build a list of drivers (distinguishing between stressors and shocks); (2) determine how the drivers might affect Coast Guard missions; and (3) filter the list for decision-relevant drivers and changes. Figure 3.2 shows these steps, and we describe them in more detail in the sections that follow.

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16 Although a full review of long-range planning literature is beyond the scope of HSOAC support to Evergreen V, the team did seek to identify any frameworks more suitable than the generic drivers-of-change approach; however, this approach is both widely used for planning and applicable to the Coast Guard given the importance of linking changes to the operating environment. In addition, we felt that, to maintain continuity within the Evergreen program, it was important to employ broadly similar methods used in previous Evergreen analyses unless there was a clear reason not to do so. Among other reasons, stakeholder familiarity with existing Evergreen approaches was an important consideration.
Figure 3.2. Stressors-and-Shocks Framework Steps

NOTE: A consideration when carrying out these steps is the identification of a decision context. This is important for scoping that occurs between steps 1 and 2.

**Step 1: Build a List of Drivers**

First, to clarify what we mean by *shocks* and *stressors*, we adapted definitions of these terms from the 100 Resilient Cities effort for the Coast Guard (pioneered by the Rockefeller Foundation; see Arup International Development, 2015):

- **Stressors** are long-term trends that will likely strain the capacity and capability of Coast Guard resources and could degrade mission readiness.
- **Shocks** are sudden, large-scale disruptions that would likely affect the completion of Coast Guard missions, the condition of the general population, or the maritime operating environment.

It is important to distinguish stressors from shocks because these drivers have differing analytical implications. A stressor is a long-term trend that, although the result of that transformation for a given future time frame might not be discernible today, lends itself to foresight and extrapolation methods. A shock, however, is more difficult to anticipate than a trend. It might be a gray swan—a known but highly unlikely event (e.g., Hurricane Katrina)—or a black swan—a completely unexpected event (e.g., the terrorist attacks on September 11, 2001). Another important consideration is the ability for stressors and shocks, particularly in dynamic environments, such as the one in which the Coast Guard operates, to permanently change the state of the system, which can become planning and management crises when unforeseen (Davis and Wilson, 2011).

**Step 2: Distinguish Drivers from the Changes They Trigger**

With a long list of potential drivers, a critical next step to help filter or prioritize decision-relevant drivers is to distinguish *drivers* from the *changes* they trigger and ultimately their impact on Coast Guard missions. Making this distinction not only is operationally important but also inherently recognizes that only some changes are of importance to the Coast Guard. For instance, a change in shipping densities and routes could be triggered by more than one driver, and a single driver can trigger changes in different domains (e.g., physical environment,

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17 In other RAND work, permanent shifts in the security environment have been termed *discontinuities* and result from the response to a shock or set of shocks (see, for example, Hoehn et al., 2018). For example, the security sector’s response to the terrorist attacks on September 11, 2001, resulted in a permanent shift in security posture, which has changed the demand for security-related operations and changed the regulatory environment.
economic trends) or across seemingly unrelated mission sets. This is also important for identifying the scale of the driver and determining the granularity that is most important for identifying mission impacts.

This concept is illustrated in Figure 3.3. A warming atmosphere (driver 1) is a megatrend that is at the root of many changes that have implications for the Coast Guard, including heat waves (change 1), thawing permafrost (change 2), and sea-ice recession (change 3). These changes have direct implications for the Coast Guard (e.g., infrastructure readiness, demand for SAR and disaster response) but might also trigger other changes, such as a shift in shipping routes (change 4, driven by change 3) or an increase in remote services (change 5, driven by change 2), that might also be triggered by other drivers or changes. For example, a shift in shipping routes might also be triggered by new hydrocarbon extraction technologies (change 7), which might be triggered by increasing resource extraction (driver 2). Similarly, an increase in remote services might be driven by offshore renewable wind energy farms (change 6), which might also be driven by increased resource extraction. These changes might affect the Coast Guard in other ways (e.g., increase demand for Coast Guard presence in the Arctic).

Figure 3.3. Notional Causal Chain from Drivers to Effect on Coast Guard Missions

It is important to note that, in some cases, changes can influence drivers as well (Figure 3.3). For example, change 3 (sea-ice recession) could, in itself, affect driver 2 (increasing resource extraction) as areas of the Arctic become less harsh and extraction costs decline.
Step 3: Filter for Decision-Relevant Drivers and Changes

The third step is to filter out drivers and changes of limited analytical use or those with marginal impact on missions (e.g., noise). We suggest three criteria for filtering drivers; a driver should be prioritized if it meets, or triggers changes that meet, any of the following conditions:

- It is certain or inevitable.
- It would necessitate substantial human and physical capital investment from the Coast Guard.
- It could significantly alter the balance, type, and distribution of Coast Guard missions.

The use of a participatory workshop, such as that summarized in the appendix, is one mechanism for filtering for decision-relevant drivers. Other means of expert elicitation, such as one-on-one interviews or small focus groups, might also be used in this step. As we describe next, it is also possible to use documents from the strategic library to help with this filtering.

Mapping Stressors and Shocks to Coast Guard Decisions

An important link between steps 1 and 2 above is tailoring the list of potentially relevant stressors and shocks to relevant Coast Guard decisions. As briefly discussed in the introduction to the report, HSOAC was not provided with a specific decision context in which to focus the Evergreen V global planning scenarios. Instead, we employed Coast Guard Strategic Plan: 2018–2022 (U.S. Coast Guard, 2018b) as a guide, particularly some aspects of readiness focused on the workforce and materiel assets, respectively. This plan lists several potential drivers of change relevant to the STRAPs listed therein: transnational criminal organizations (TCOs) and nonstate actors, great-power competition, the cyber domain, technological advancement, changes in the Arctic, disaster response, and force readiness. These drivers provided a starting point for compiling and filtering the lists of stressors and shocks included in Tables 3.1 and 3.2. To fully populate these tables, we gathered information on potentially relevant shocks and stressors from several sources: literature;\(^{18}\) team members’ expertise; the October 22, 2018, workshop (described in the appendix); and a survey administered by DCO-X advertised Coast Guard–wide (DCO-X, 2018; described in Van Abel, Wilson, and Anania, unpublished). Tables 3.1 and 3.2 articulate these stressors and shocks—representing the culmination of steps 1 through 3 in the process described above—respectively.

\(^{18}\) For example, we reviewed Office of the Director of National Intelligence, undated; UK Ministry of Defence, 2014; UK Ministry of Defence, 2018; and Manyika et al., 2013.
Table 3.1. Potential Stressors, by Aspect of the Maritime Strategic Environment

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Stressor</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCOs and nonstate actors</td>
<td>Changing natural narcotic regions and availability(^{a,b,c})</td>
</tr>
<tr>
<td>Cyber domain</td>
<td>Data privacy and integrating technology into daily life(^{a})</td>
</tr>
<tr>
<td></td>
<td>Increasing use of networking data and communications(^{a,c})</td>
</tr>
<tr>
<td></td>
<td>Technological diffusion—making it easier for small groups to have more power and sophisticated capabilities(^{b,c,d})</td>
</tr>
<tr>
<td></td>
<td>Enhanced C5I technologies and declining cost of and increasing access to remote sensing(^{b,c})</td>
</tr>
<tr>
<td></td>
<td>Miniaturized and more-capable sensor networks with smart and connected equipment for maintenance, monitoring, and efficiency(^{a})</td>
</tr>
<tr>
<td></td>
<td>Increased use of portable and wearable technology(^{b})</td>
</tr>
<tr>
<td></td>
<td>Cloud storage and cloud computing(^{b,e})</td>
</tr>
<tr>
<td>Technological advancement</td>
<td>Geoengineering to reduce the impact of climate change(^{b})</td>
</tr>
<tr>
<td></td>
<td>Expanding use of artificial intelligence and machine learning(^{a,b,e,f,g})</td>
</tr>
<tr>
<td></td>
<td>Increasing use and integration of automation, including knowledge work(^{a,c,e,g})</td>
</tr>
<tr>
<td></td>
<td>Increasing data processing power, analytic capabilities, and miniaturization(^{a})</td>
</tr>
<tr>
<td></td>
<td>Increased use of unmanned vehicles (surface, underwater, and aerial) in the maritime domain(^{a,b,c,e})</td>
</tr>
<tr>
<td></td>
<td>Influence of technology and managing change(^{d,g})</td>
</tr>
<tr>
<td></td>
<td>Advanced robotics(^{a})</td>
</tr>
<tr>
<td></td>
<td>Increase in Arctic services(^{a,c})</td>
</tr>
<tr>
<td></td>
<td>Increasing offshore energy-related activities(^{a,c})</td>
</tr>
<tr>
<td></td>
<td>Development of deep-drilling technologies and hydrocarbon extraction technologies(^{a,b,e})</td>
</tr>
<tr>
<td></td>
<td>Declining cost of battery storage technology(^{b,e})</td>
</tr>
<tr>
<td></td>
<td>Lower-cost alternative and renewable energy(^{b,e})</td>
</tr>
<tr>
<td></td>
<td>Decreasing or increasingly variable fossil fuel availability(^{d})</td>
</tr>
<tr>
<td>Changing Arctic</td>
<td>Accelerating sea-ice recession and increasing amounts of free ice(^{a,b,c})</td>
</tr>
<tr>
<td></td>
<td>Shifting shipping routes(^{a,b,c})</td>
</tr>
<tr>
<td></td>
<td>Thawing permafrost effects on infrastructure and isolated indigenous communities(^{a,b})</td>
</tr>
<tr>
<td>Disaster response</td>
<td>Deepening heat waves and increasing urban heat island effects(^{a})</td>
</tr>
<tr>
<td>Force readiness</td>
<td>Global mass cooling(^{a})</td>
</tr>
<tr>
<td></td>
<td>Sea level rise (e.g., flooding from storm surge, erosion)(^{a,b})</td>
</tr>
<tr>
<td></td>
<td>Increasing number of mitigation and adaptation projects (e.g., barriers, navigable infrastructure)(^{b})</td>
</tr>
<tr>
<td></td>
<td>Increasing underperforming infrastructure because of prior standards, incorrect location, or failure before end of useful life(^{b})</td>
</tr>
<tr>
<td></td>
<td>Increased frequency or intensity of tropical storms(^{a,c})</td>
</tr>
<tr>
<td></td>
<td>Changing weather patterns and higher floodwaters(^{a,c})</td>
</tr>
<tr>
<td></td>
<td>Riverine flooding and ice navigation hazards(^{a,b})</td>
</tr>
<tr>
<td>Aspect</td>
<td>Potential Stressor</td>
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<tr>
<td>----------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Increased drought and reduction of riverine shipping capacity and lock function&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>Changes in disease burdens with pandemics or epidemics (also connected to population density)&lt;sup&gt;b,f&lt;/sup&gt;</td>
</tr>
<tr>
<td>Expanding humanitarian and training missions with international partners&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Increased blurring of missions&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Increasing storm and disaster response and indirect support to the Federal Emergency Management Agency&lt;sup&gt;a,b,c&lt;/sup&gt;</td>
<td>Shift in perception of law enforcement relative to military power—increasing use at a level below military intervention, making the Coast Guard a target in harm’s way&lt;sup&gt;b,h&lt;/sup&gt;</td>
</tr>
<tr>
<td>Increasing technical and specialist work requirements—shortage of aviators&lt;sup&gt;a,b,c&lt;/sup&gt;</td>
<td>Ever-increasing scale of global population and economic growth, with declining time for policy response&lt;sup&gt;a,c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Differential majority–minority growth, increasing immigration, increasing transnational identities, and changing levels of ethnic diversity and language assimilation&lt;sup&gt;a,f,g&lt;/sup&gt;</td>
<td>Changing workforce demographics and policies&lt;sup&gt;a,b,g&lt;/sup&gt;</td>
</tr>
<tr>
<td>Shift in recruiting and retention potential—civilian versus DoD careers, retirement benefits, and midcareer hires&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>Increasing concerns about workforce and workplace well-being&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Human–machine interface and shifting division of labor&lt;sup&gt;b,g&lt;/sup&gt;</td>
<td>Aging U.S. population and declining labor force participation rates&lt;sup&gt;b,f&lt;/sup&gt;</td>
</tr>
<tr>
<td>Increasing remote work and gig economy versus full-time employment&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Increasing domestic inequality—impact on recruiting, retention, and training opportunities&lt;sup&gt;b,g&lt;/sup&gt;</td>
</tr>
<tr>
<td>Increasing cooperation among governments and the private sector and industry with outsourcing and contracting&lt;sup&gt;b,d,i&lt;/sup&gt;</td>
<td>Expanding biotechnology and improving advanced human health&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>Increasing affordability challenges&lt;sup&gt;g&lt;/sup&gt;</td>
<td>Declining ability to maintain aging assets&lt;sup&gt;a,c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Shifting budget dictates by mission needs, Congress, the president, CCG, or other exogenous events&lt;sup&gt;b,c&lt;/sup&gt;</td>
<td>Improving advanced materials and manufacturing (three-dimensional and additive printing)&lt;sup&gt;b,c,e,f&lt;/sup&gt;</td>
</tr>
<tr>
<td>Increasing complexity of the supply chain and potential vulnerabilities with critical technologies&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Other</td>
</tr>
<tr>
<td>Wildlife migration and human interface issues—safety, health, and endangered species&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Accelerating and broader fishery migration&lt;sup&gt;a,c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Increasing pressures on the food economy, fisheries, and protein sources&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Ocean acidification and salinity&lt;sup&gt;a,b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Increased ocean pollution (e.g., plastics, garbage patches)&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Declining estuarine and near-coast quality&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Declining estuarine and near-coast quality&lt;sup&gt;b&lt;/sup&gt;</td>
<td>Level of coordination and cooperation between the commercial and defense sectors&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Increasing internal (and external) migration to the coasts&lt;sup&gt;a,c&lt;/sup&gt;</td>
<td>Other</td>
</tr>
<tr>
<td>Aspect</td>
<td>Potential Stressor</td>
</tr>
<tr>
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</tr>
<tr>
<td>TCOS and nonstate actors</td>
<td>Increasing coastal tourism and leisure activities, including recreational traffic&lt;sup&gt;a,b,c&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Increasing urbanization&lt;sup&gt;c,f,h&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Increasing port agglomeration, coastal lightering, and transshipment&lt;sup&gt;b,c&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

**NOTE:** C5I = command, control, communications, computers, cyber, and intelligence. According to National Ocean Service, 2018, “Lightering is the process of removing oil or other hazardous chemicals from a compromised vessel to another vessel to prevent oil from spilling into the surrounding waters.”

<sup>a</sup> SOURCE: Coast Guard SMEs at Evergreen V workshop, October 2018, or DCO-X, 2018.
<sup>b</sup> SOURCE: HSOAC SMEs.
<sup>c</sup> SOURCE: U.S. Coast Guard, 2018b.
<sup>d</sup> SOURCE: U.S. Coast Guard, 2005.
<sup>e</sup> SOURCE: Manyika et al., 2013.
<sup>f</sup> SOURCE: Office of the Director of National Intelligence, undated.
<sup>g</sup> SOURCE: UK Ministry of Defence, 2018.
<sup>h</sup> SOURCE: UK Ministry of Defence, 2014.
<sup>i</sup> SOURCE: U.S. Coast Guard, 2013.

### Table 3.2. Potential Shocks, by Aspect of the Maritime Strategic Environment

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Potential Shock</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCOS and nonstate actors</td>
<td>Shift in rates and distribution of poverty, development, and standard of living&lt;sup&gt;a,b&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Hybrid warfare with state-disguised or -denied and stateless actors&lt;sup&gt;c,d,e,f&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Failed-state chaos, warring factions, and extremism&lt;sup&gt;c,e,g&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>General blurring of states of peace and war, both overseas and domestically&lt;sup&gt;f,h&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Increase in chronically youthful states&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Change in global mobility and the permeability of borders&lt;sup&gt;d,i&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Shift in perceptions of asylum and human trafficking enforcement&lt;sup&gt;d,e&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Increasing cultural acceptance of drug legalization versus changing preferences for synthetic drugs&lt;sup&gt;c,d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Great-power competition</td>
<td>Shift in strengths of global education and innovation and the distribution of knowledge&lt;sup&gt;a,h&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>U.S. and Asian bilateral relations&lt;sup&gt;c,e&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Global trade network shock, change in alliance structure, or shift in rule-based international systems for stability and cooperation limiting soft power&lt;sup&gt;c,d,e,f,g,h&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Embargo of critical resources to the United States (for example, rare-earth metal supply)&lt;sup&gt;d,h&lt;/sup&gt;</td>
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<tr>
<td></td>
<td>Foreign-influence campaigns and territorial conflict&lt;sup&gt;c,e&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Foreign encroachments on the U.S. maritime domain or exclusive economic sovereignty&lt;sup&gt;c,d,e,g,i&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Major conflict involving U.S. forces or changed distribution of military power requiring rapid escalation&lt;sup&gt;d,e,i&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Proliferating advanced weaponry and weapons of mass destruction&lt;sup&gt;d,e,f,g&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Change in the strength or weakness of the maritime legal regime&lt;sup&gt;i&lt;/sup&gt;</td>
</tr>
<tr>
<td>Cyber domain</td>
<td>Increasing cyber vulnerability and expanding unregulated information space&lt;sup&gt;c,e,g&lt;/sup&gt;</td>
</tr>
<tr>
<td></td>
<td>Increasing capabilities for stand-off and remote attacks&lt;sup&gt;c,f&lt;/sup&gt;</td>
</tr>
<tr>
<td>Aspect</td>
<td>Potential Shock</td>
</tr>
<tr>
<td>--------------------------------</td>
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</tr>
<tr>
<td>Technological advancement</td>
<td>Change in attitudes, ethics, and values related to technological developments¹</td>
</tr>
<tr>
<td></td>
<td>Change in sources of funding for technological development—government versus</td>
</tr>
<tr>
<td></td>
<td>private¹</td>
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<tr>
<td></td>
<td>Changes in boat design—energy and refueling, propulsion technology, high-</td>
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<tr>
<td></td>
<td>performance hulls, and post-Panamax size²,³,⁴</td>
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<tr>
<td></td>
<td>Changes in fishing gear—long line, deep nets, sonar, and aerial intelligence⁵,⁶</td>
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<tr>
<td></td>
<td>Change in land-based logistics—containerization²,³</td>
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<td></td>
<td>Change in harbor logistics—offshore oil and gas buoys and unloading to smaller</td>
</tr>
<tr>
<td></td>
<td>draft ships²,³</td>
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<tr>
<td>Disaster response</td>
<td>Regional or persistent red tide²</td>
</tr>
<tr>
<td></td>
<td>Environmental disaster (e.g., oil spill, radiological dispersion)⁴</td>
</tr>
<tr>
<td></td>
<td>Agricultural collapse or extreme drought exceeding available aid, resulting in</td>
</tr>
<tr>
<td></td>
<td>climate refugees⁴</td>
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<tr>
<td></td>
<td>Regional epidemic or global pandemic⁴</td>
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<tr>
<td></td>
<td>Earthquake or tsunami—infrastructure destruction²</td>
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<td></td>
<td>Space weather event²</td>
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<td></td>
<td>Earth magnetic field reversal²</td>
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<tr>
<td>Force readiness</td>
<td>Organizational goals and structures unable to respond to complex threats and</td>
</tr>
<tr>
<td></td>
<td>government capacity to respond to change²,³,⁴,⁵</td>
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<tr>
<td></td>
<td>Innovations in law enforcement strategy (e.g., community-based policy, multimission</td>
</tr>
<tr>
<td></td>
<td>fire departments)²</td>
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<tr>
<td></td>
<td>Public attitude toward and acceptance of force deployment⁶</td>
</tr>
<tr>
<td>Other</td>
<td>Negative global economic shock—currency, debt, or energy crisis²,³</td>
</tr>
<tr>
<td></td>
<td>Negative domestic economic shock—credit crisis²,³</td>
</tr>
<tr>
<td></td>
<td>Labor unrest or sudden changes in patterns or the level of unemployment²,³</td>
</tr>
<tr>
<td></td>
<td>Declining U.S. economic competitiveness as sources of major growth and productivity</td>
</tr>
<tr>
<td></td>
<td>increases are flagging⁴</td>
</tr>
<tr>
<td></td>
<td>U.S. and Central American bilateral relations²,³</td>
</tr>
<tr>
<td></td>
<td>The United States imposing country-based sanctions²,³</td>
</tr>
<tr>
<td></td>
<td>Rate of and tensions between globalism and nationalism or protectionism⁷,⁸</td>
</tr>
<tr>
<td></td>
<td>Conflict between secularism and religion⁶</td>
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<tr>
<td></td>
<td>Changing attitudes toward the environment⁶</td>
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<tr>
<td></td>
<td>Truth decay, increasing acceptance of corruption, and declining trust in</td>
</tr>
<tr>
<td></td>
<td>government²,³,⁷</td>
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<tr>
<td></td>
<td>Change in U.S. energy policy and subsidization⁴</td>
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<tr>
<td></td>
<td>Differential or conflicting environmental regulations—state and international</td>
</tr>
<tr>
<td></td>
<td>levels⁴</td>
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<tr>
<td></td>
<td>Increased public scrutiny and alternative accounts of law enforcement action—body</td>
</tr>
<tr>
<td></td>
<td>cams, public relations crisis⁴</td>
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<tr>
<td></td>
<td>Change in the role and influence of nongovernmental organizations⁸</td>
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<tr>
<td></td>
<td>Change in the predominant ideology function of governments—variation in structure</td>
</tr>
<tr>
<td></td>
<td>and strategy⁸</td>
</tr>
<tr>
<td></td>
<td>Perception of serious threat to U.S. security or quality of life⁸</td>
</tr>
<tr>
<td>Aspect</td>
<td>Potential Shock</td>
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<tr>
<td></td>
<td>Increasing grassroots and collective movements associated with generational change&lt;sup&gt;h&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

NOTE: *Panamax* refers to the size of a vessel that could traverse the original locks at the Panama Canal. *Post-Panamax* refers to the size of a vessel too large to traverse the newest locks at the canal.

<sup>a</sup> SOURCE: Evergreen, 1998.
<sup>b</sup> SOURCE: Evergreen, 2008.
<sup>c</sup> SOURCE: Coast Guard SMEs at Evergreen V workshop, October 2018, or DCO-X, 2018.
<sup>d</sup> SOURCE: HSOAC SMEs.
<sup>e</sup> SOURCE: U.S. Coast Guard, 2018b.
<sup>f</sup> SOURCE: Office of the Director of National Intelligence, undated.
<sup>g</sup> SOURCE: UK Ministry of Defence, 2018.
<sup>h</sup> SOURCE: UK Ministry of Defence, 2014.
<sup>i</sup> SOURCE: U.S. Coast Guard, 2005.

With the planning scenario “ingredients” in hand, we next turn to the construction of example narratives that form the scenarios themselves.
The use of scenarios has been a key aspect of the Evergreen approach throughout its history. The lessons from past Evergreen strategic foresight activities suggest that using scenarios as an analytic tool was generally considered useful and fits well with Coast Guard culture. However, individual scenarios themselves do not appear to have served their intended analytic purposes consistently. Prior Evergreen participants suggest that they were sometimes off the mark—not relevant for the hard choices the service was facing, too tactical in focus, or not really reaching over the horizon. Furthermore, other lessons highlighted a desire for more-structured development of Evergreen analysis and scenario-based products that directly add value to decisionmaking in different Coast Guard offices. The importance of decision relevance is also highlighted in the review of Coast Guard PPBE and the strategic library discussed in Chapter 2.

Our Overarching Scenario Development Approach

To address these issues, we surveyed a variety of scenario-based analytic approaches that are well described in the academic literature and widely applied in practical settings. The purpose of this survey was to glean information about structured ways to generate decision-relevant scenarios from information about multiple types of change drivers, such as those presented in Chapter 3. We sought approaches in which meaningful scenarios are defined by how they will be used—that is, what decisions they inform. Importantly, we looked for ways to break down a highly dimensional set of possibilities in a repeatable, relatively simple way that could employ qualitative or quantitative criteria for designing scenarios relevant to a variety of decisions the Coast Guard faces.

As introduced in Chapter 1, we reviewed DMDU-related approaches that rely on some form of scenario-based analysis. Here, we describe these approaches in more detail before explaining why we used DMDU concepts to guide our proposed updated Evergreen scenario development process. DMDU methods build from several fundamental insights. First, because we cannot predict the deeply uncertain future, DMDU methods leverage scenarios to simulate a wide variety of plausible future conditions within which strategies and plans might succeed or fail to meet predefined criteria. Second, the focus of DMDU methods is evaluating strategies according to how well they perform across a variety of futures rather than seeking “optimal” performance in a “most likely” future. Third, DMDU methods often encourage building flexibility or adaptivity into strategies in order to increase their robustness to uncertainty. Finally, these

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19 In other words, the content of the scenarios is defined by the specific decisionmaking context they are intended to support.
methods are often designed to support participatory decisionmaking in workshops or other settings and are intended to highlight key trade-offs for decisionmakers to resolve when looking at different scenarios or balancing planning goals.

Key DMDU methods we reviewed for insights on scenario development and analytic employment (which should be linked\(^{20}\)) included the following:

- **assumption-based planning**: a method based on the premise that plans tend to fail when underlying critical assumptions are broken. Provides a qualitative approach for identifying these assumptions and devising strategies that either are less sensitive to broken assumptions or reduce the likelihood of critical broken assumptions. See Dewar et al., 1993.

- **Dynamic Adaptive Policy Pathways (DAPP)**: an approach that produces an adaptive plan with alternative routes into the future that are informed by a planner’s strategic vision, short-term actions, and Adaptation Tipping Points (discussed in more detail in Chapter 4). Provides an approach for identifying useful scenarios and defining adaptive strategies using qualitative or quantitative means. See Haasnoot et al., 2013.

- **info-gap decision theory**: a method that, through a series of models, seeks to illuminate trade-offs, risk, and vulnerabilities for decisionmakers based on an a priori judgment of the worst tolerable consequence or scenario. See Ben-Haim, 2006.

- **portfolio analysis**:\(^{21}\) an approach focused on managing strategic risk through multiobjective modeling of alternatives. Requires statistical information about the performance of different actions that can then be combined into portfolios that maximize returns while minimizing risk.

- **robust decisionmaking**: an approach that evaluates the performance of different strategies across a large set of plausible future scenarios in order to quantitatively define key vulnerabilities and define more-robust strategies. See Lempert, Popper, and Bankes, 2003, and Marchau et al., 2019.

We sought a scenario development approach appropriate for use in the context of DMDU methods for two reasons. First, these approaches generally emphasize the importance of decisionmaker and stakeholder engagement in the process of selecting and analyzing scenarios, an important facet of Evergreen’s past activities. They are also well documented in the academic literature and are generally designed for adaptation to new applications.

Second, Coast Guard strategic foresight analyses require some consideration of deep uncertainty. DCO-X was interested in maintaining Evergreen’s focus on scenario-based analysis using futures looking forward around 20 to 30 years. Some aspects of Coast Guard operations are not deeply uncertain—for example, the service’s statutory missions and authorities are numerous and varied but fairly well defined and unlikely to drastically change in that time frame. However, the Coast Guard’s operating environment could be substantially altered in the medium term by

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\(^{20}\) Scenario development is itself an analytic process that is guided by an overarching approach to evaluating strategies or plans, such as the DMDU methods described here.

\(^{21}\) There are several different flavors of portfolio analysis. We include reference to one with a foundation in national security strategic planning: Davis and Dreyer, 2009.
numerous drivers—climate and environment, economics, technology (of threats and hazards, as well as service capabilities), geopolitics, and demography and culture (internal and external to the service), among others—which results in a multidimensional set of future possibilities through which to sort. Furthermore, the Coast Guard frequently responds to contingencies and makes other excursions, such as day-to-day execution of statutory missions, that introduce uncertainty to planning. For example, disasters are inevitable, and the Coast Guard is frequently involved in U.S. response as a lead or supporting organization.22

Ultimately, we made the assumption that the scenario development process demonstrated here would be applied in the context of a DMDU approach (such as DAPP) that can employ qualitative scenarios.23 Many DMDU approaches ultimately rely on quantitative scenarios to execute the analysis. Although Evergreen might benefit from the use of quantitative scenarios, the present format uses scenarios built from qualitative information. DAPP is one DMDU approach that can both leverage qualitative or quantitative scenarios and align well with other goals and constraints of Evergreen. We do not prescribe a specific approach for Evergreen to employ scenarios, but, in Van Abel, Wilson, and Anania, unpublished, we illustrate scenarios applied in a DAPP context to an Evergreen-style problem. The four specific steps to operationalize scenario development that we propose below are not outlined in the DMDU literature or specifically associated with DAPP. However, they are consistent with the ideas and adapt from prior work developing qualitative scenarios for use with these approaches:

1. Define a decision context (discussed previously).
2. Create scenario families—alternative representations of the future along common axes of change—based on qualitative intersections of key stressors. These external stressors are selected from the framework in Chapter 3 based on their potential internal effects on the Coast Guard or the potential relevance of their impact on the decision context.
3. Identify some exemplar qualitative shocks (also drawn from Chapter 3) consistent with the dimensions of change outlined by the scenario families. Whereas stressor-based scenario families model futures in which slow-burning trends or emerging long-term issues shape (in this case) day-to-day demands for Coast Guard missions, shocks simulate shorter-term perturbations that have an initial effect of drawing large amounts of resources toward a contingency that might ultimately have lasting effects on the future world.24

22 We note, however, that disaster response is not clearly articulated in the Coast Guard’s statutory missions at present, although some specific related elements (e.g., search and rescue) are.
23 We made this assumption in order to more robustly steer the scenario development method; however, the resulting scenarios could be used—or at least could serve as a starting point—to facilitate decision analysis using other approaches.
24 The 9/11 terrorist attacks are an excellent example of a perturbation that initially consumed a great deal of Coast Guard (and many other) resources and ended up reshaping the world in a way that had deep impacts on Coast Guard operations.
4. Combine—to the desired level of complexity appropriate for the decision context—scenarios from different families and relevant shocks into scenario narratives that can be used to gain insights to support decisionmaking.

In the next section, we describe the setup for developing stressor-based scenario families and provide some abbreviated scenario narratives as illustrative examples. For each scenario family, we also describe exemplar shock narratives. In practice, the narratives for stressor-based scenario families and shocks we discuss here would be sewn together to simulate the alternative future conditions for which SMEs are asked to evaluate potential strategies or plans. Appendix B contains full-length exemplar global scenarios used as the basis for Evergreen activities in FYs 2019 and 2020.

The scenarios discussed here leverage a limited number of stressors and shocks for the purposes of setting up a tractable example. They illustrate and set the foundations for future Evergreen scenario development. Even without a great deal of complexity, they are global in at least two ways. First, they take into consideration drivers that can have an impact at the global scale, even if, in some cases, the most-pertinent implications for the Coast Guard might be more regional. Second, the scenario families and stressors are intentionally generalizable and modular. Additional analysis can connect them to the wide variety of shocks and drivers available for consideration, including geostrategic competition with near peers or broader regional instabilities in Central and South America, Africa, and the Indo-Pacific region.

**Stressor-Based Scenario Families**

This section describes our approach for developing exemplar Evergreen global planning scenarios that could support decision analysis for the two readiness subobjectives from the strategic plan introduced earlier: cultivating the mission-ready total workforce and modernizing assets, infrastructure, and mission platforms. Ultimately, we created two stressor-based scenario families (Workforce and Asset), example shocks, and a third family built from two key considerations (budget and authority control, and alignment of resources) that are relevant for Coast Guard leadership strategic decisionmaking in any scenario family, including the two discussed here.

First, we briefly define four terms that are important to distinguish for the purposes of this discussion:

- **A scenario family** is a $2 \times 2$ matrix representing the interactions of two global stressors or trends, along with the universe of possible outcomes resulting from these trend interactions. Each cell in the matrix is a **scenario**. Together, the four cells allow for an exploration of the different configurations of opportunities and constraints that will likely affect Coast Guard decisionmaking.

- **A scenario** is a cell in the scenario family matrix that defines a group of related futures that represent the same directionality for both trends that define the family. We can consider a narrative for a given scenario to be a proxy for a variety of similar **futures** in
which the underlying trends point in the same direction. This chapter presents narratives for exemplar scenarios.

- **A future** is one of many possible outcomes of the confluence of two stressors. Each scenario can be a proxy for multiple futures. A very simple representation of futures could be a “low, medium, high” realization of stressor impacts within each scenario. We do not present detailed narratives for exemplar futures in this report. A more granular decision context is needed to do this robustly.

- The **shock** narratives associated with particular scenario families are intended to provide a mechanism for simulating the tension between day-to-day demands and temporary perturbations that can require sudden diversions of capabilities for weeks, months, or even years to follow. The shocks are a way of amplifying the demands on the Coast Guard in any particular stressor-based scenario.

Overall, the idea we propose is that each decision being supported through scenario-based analysis is connected to a set of drivers and shocks, some common across different decisions. Here, we present two broad scenario families defined by the types of decisions they affect. Given the foremost concerns of *Coast Guard Strategic Plan: 2018–2022* (U.S. Coast Guard, 2018b), we developed the Workforce and Asset scenario families, providing example shock narratives for each.

Using the stressors-and-shocks framework introduced in Chapter 3, we held three internal SME reviews to map stressors and shocks to the workforce- and asset-related strategic plan subobjectives. In contrast to narrowly defined MARs, Evergreen examines the whole Coast Guard across missions and functions. Thus, in our SME reviews, if a stressor or shock touched on three or more strategic plan subobjectives related to workforce or assets, we included it for further development. Ultimately, the HSOAC internal workshops reduced the complex, causally rich decision space for each family to two key change dimensions (axes). We prioritized choices of axes based on expert judgment about which stressors were most relevant to the success or failure of workforce or asset (respectively) objectives.

Figure 4.1 visually depicts this generic process of reducing a complex decision space with multiple potential causal relationships to the two key change dimensions (axes) that allow us to create a scenario family. This example from the Workforce scenario family shows the external market competitiveness for career fields in the Coast Guard versus the specialization of skills needed to conduct missions. For example, demographic and educational changes could result in

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25 Conceptually, a perturbation might alter the operating environment over the long term—examples include the 9/11 terrorist attacks and prominent hurricanes.

26 This is why using a stressors-and-shocks framework as part of a scenario development process does not require starting from scratch for each new decision being analyzed.

27 Full identification and classification of the planning decisions that the Coast Guard faces lie outside the scope of the present analysis. The narratives given represent situations that could come to be by 2040, in line with Evergreen’s analytic time horizon. However, changes might happen faster than that. We do not attempt to predict the timelines for change.

28 The latter might be considered a proxy for external technological changes.
a smaller pool of available and capable labor, or the career marketplace of comparable employers could make recruiting and retention easier from a Coast Guard perspective. These constituent stressor trends are combined into a scenario—in this case, Up or Overboard. Note that, if quantitative data or models were available, DMDU methods, such as robust decisionmaking, also provide scenario discovery approaches to identify key dimensions that define axes based on quantitative analysis (Bryant and Lempert, 2010).

Figure 4.1. An Example of the Workforce Scenario Family in a Multidimensional Uncertainty Space

At first approach, the use of 2×2 matrices seems similar to historical Evergreen analyses, which is one reason it was appealing (to provide continuity). However, there are several important differences. First, using the stressors-and-shocks framework to define dimensions enables the development of complex change vectors. This is because this framework allows users to articulate different components and implications of change drivers and combine them (by selecting one scenario from each family) when it makes sense to do so for a particular decision.

Second, we separated shocks into a somewhat independent category of modular components that can be added to scenarios. This structural feature provides flexibility in the development of scenarios. Evergreen can focus on response to particular situations through the inclusion of diverse shocks, or analyses can consider only day-to-day needs by not including shocks at all. Some scenarios might include shocks to gauge response capability or instead might introduce a perturbation to incorporate uncertainty about evolving future demands. Fundamentally, the relevance of a shock depends on whether the shock meaningfully interacts with current driver trends and influences the decisions at hand.

Finally, we conclude this chapter with a short presentation of the drivers in common between the Workforce and Asset scenario families, which include common resource allocation and distribution considerations. These can be thought of as alternative sets of assumptions to
accompany the modular stressor-based scenarios and shocks that can be combined to form a single, comprehensive global narrative.

**The Workforce Scenario Family**

Objective 1.1 of *Coast Guard Strategic Plan: 2018–2022* (U.S. Coast Guard, 2018b) is to cultivate the mission-ready total workforce, which includes such focus areas as recruitment, training, and retention. The plan specifically emphasizes aspects that include knowledge, skills, and equipment (including digital tools). It also emphasizes diversity goals and aims for the Coast Guard to be perceived as an employer of choice. One of the interesting aspects of this objective from the perspective of scenario development is that, although the Coast Guard has explicit control over some workplace factors, other issues, such as broader U.S. workforce trends and demographics, are outside of Coast Guard control.

HSOAC SMEs participating in the internal workshops identified two primary dimensions (there are others) that could affect the mission-ready total workforce in the future: (1) the attractiveness or competitiveness of Coast Guard careers relative to those in the broader job market and (2) the external demand potentially placed on the Coast Guard for specialized or generalized labor to fulfill mission needs. Table 4.1 lists the specific types of stressors associated with each dimension that we considered in building the scenario families.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Stressor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market competitiveness of careers</td>
<td>Increasing seasonal work or a gig economy versus full-time employment</td>
</tr>
<tr>
<td></td>
<td>Increasing emphasis on affordability and quality of life, along with an elevated expectation of remote work opportunities</td>
</tr>
<tr>
<td></td>
<td>Changing workforce demographics (e.g., sexual identity, family and caregiving situations, foreign nationals)</td>
</tr>
<tr>
<td></td>
<td>Shifting recruiting and retention norms and expectations (stability, incentives, retirement benefits, experienced midcareer hires)</td>
</tr>
<tr>
<td>Specialization of mission</td>
<td>Aging population and declining labor force participation rates</td>
</tr>
<tr>
<td>requirements</td>
<td>Increasing technical and specialist work requirements</td>
</tr>
<tr>
<td></td>
<td>Strengthening of cooperation among governments and the private sector or industry through outsourcing and contracting</td>
</tr>
<tr>
<td></td>
<td>Rising complexity of operations</td>
</tr>
</tbody>
</table>

We used these example stressors to frame the dimensions of the Workforce scenario family. One important assumption for the development of this scenario family is that a generalist Coast Guard would have more distinct types of specialties than a more specialized service would; in the latter, certain functions might be automated or transferred to another organization. We also assumed that any rapid moves toward high specialization of mission requirements would likely result (initially, at least) in a shortage of qualified potential candidates already in the Coast
Guard. A final assumption is that the Coast Guard must be competitive in the labor market in order to attract and retain the mix of skills needed and to prevent other services or the private sector from enticing specialized service members or the most-promising recruits. Figure 4.2 maps the four resulting scenarios along these two dimensions.\(^{29}\)

**Figure 4.2. The Workforce Scenario Family**

<table>
<thead>
<tr>
<th>Low</th>
<th>Specialization of mission requirements</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strong</td>
<td>1. Captain’s Got a New Gig</td>
<td>2. Up or Overboard</td>
</tr>
<tr>
<td>Weak</td>
<td>3. Try Switching to Aux</td>
<td>4. Silicon Sloop Slump</td>
</tr>
</tbody>
</table>

In Figure 4.2, each cell represents the potential interactions between the two dimensions—for which, for the sake of simplicity, we consider only a low and a high value—when combined. The scenario names illustrate some of the key characteristics of each combination and are discussed in more detail below. The purpose of the matrix presented here is to facilitate a thought exercise about the worlds, or scenarios, created by different combinations along the two dimensions identified as particularly relevant for the Coast Guard. We did not make any assumptions, however, about where the Coast Guard currently stands within this matrix. Furthermore, there are several possible variants (futures) for each scenario when we add details. Conceptually, some futures (closer to the middle of the quadrant) would represent less-extreme conditions than in

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\(^{29}\) We recognize that other dimensions besides these two are relevant. However, seasonal and temporary work versus full-time employment, for instance, is a trend that could add an element of complexity to each of the scenarios in the Workforce family.
those futures closer to the edges. In the rest of this section, we describe the conditions for each of
the scenarios represented in these cells.

Workforce Scenario 1: Captain’s Got a New Gig

With an American workforce accustomed to technological change and consuming new
information, military generalists using off-the-shelf tools in common with the private sector are
valued over specialists. Continued strong coastal population growth, despite an aging workforce,
brings steady labor availability and participation rate close to many ports (and along inland
waterways). Government careers are generally attractive, thanks to additional benefits, more-
flexible schedules, higher salaries, and sustained attention paid to members’ quality of life
(including job stability, health care provision, and retirement benefits). Temporary and part-time
workers are readily available to surge the workforce—for instance, during disaster response.

Workforce Scenario 2: Up or Overboard

With a drive to incorporate the latest technology, careers require a great degree of
specialization, expertise, and experience. Effective government communication campaigns have
encouraged young people searching for meaningful careers in public service to take on new
vocations that are compatible with their expectations for work–life balance. Employees expect
excellent quality of life, such as additional benefits, more-flexible schedules, and higher salaries.
Advanced analytics have greatly improved the efficiency and effectiveness of human resources
such that elite operators and expert analysts are allocated to missions, and their skills are
empowered.

Workforce Scenario 3: Try Switching to Aux

The U.S. government struggles to compete in the labor market with more-attractive
employers, leaving it with mostly legacy skills and training deficits while talent goes to the
private sector. Retaining skilled and specialized employees is also increasingly difficult.
Government employers ponder the feasibility of outsourcing additional work, using temporary
employees, and reducing demand on services (e.g., pushing for industry to engage in greater self-
regulation). Against this backdrop, the relative economic importance of coastal areas is rapidly
declining. Mass migration inland has made coastal areas more affordable.

Workforce Scenario 4: Silicon Sloop Slump

The future workplace requires high levels of training and experience to meet specialized
information and technology needs. The government has doubled down on technology, using
predictive analytics to lighten demands on the workforce. Private companies have adapted and
surged ahead in terms of the attractiveness of their careers. Turnover in government positions is
high, further stressing an already-weakened and -inadequate training system. Employees are
demanding more choice in where they live, especially considering the high density and costliness
of coastal areas. Eroding job stability and limited retirement benefits have dissuaded high-quality
applicants from government and service careers for the better part of a generation. The lack of labor supply exacerbates locked-in demand for specialization. Such concepts as lateral entry, limited relocation, and remote work are gaining support in the government workforce.

Workforce Scenario Family Shock Examples

This scenario family is closely linked with the policy or regulatory space, which can be highly influenced by technology- and socioeconomic-based shocks, according to SME elicitation and other information collection that supported the first iteration of the stressors-and-shocks framework. In Table 4.2, we summarize examples of shock types related to technology and socioeconomic factors and their potential positive, negative, or ambiguous impact on the Coast Guard’s statutory missions. We also include the potential influence on decisionmaking, which suggests the type of reaction decisionmakers might have to the type of shock in question.

These shocks could take place against the background of any of the four scenarios in the Workforce family, although some would be more relevant to particular scenarios than others. Furthermore, some shocks could be more likely to reoccur or more severe when linked with some scenarios than others. For example, if the Coast Guard had lower specialization rates and weaker market competitiveness, these factors could theoretically leave the service more exposed to cyber vulnerabilities.

Now, we introduce two examples of specific shock narratives that could be associated with the Workforce scenario family.

Workforce Shock Narrative 1: Putting All Our Magnets in One Basket

For a first example, we explored the potential role of the Coast Guard’s workforce in resolving the ambiguities of a geomagnetic storm combined with a crippling cyberattack. This shock is most compatible with Up or Overboard and Silicon Sloop Slump.

In the late fall and early winter, the Coast Guard Navigation Center receives multiple reports of intermittent global navigation satellite system (GNSS) signal quality and reliability issues in much of districts 1, 5, 8, and 9. NOAA’s Space Weather Prediction Center had predicted extreme space weather with the potential for a moderate geomagnetic event but not at this scale or level of complication and ambiguity (see Figure 4.3). Affected areas include southern New England, from Cape Cod through the Connecticut shoreline; the vicinity of the Port of New York and New Jersey; Delaware Bay; most of the Chesapeake Bay (including the Port of Baltimore); Hampton Roads; Lakes Superior and Huron; and the Mississippi River from St. Louis to the Gulf of Mexico.
**Table 4.2. Selected Technology and Socioeconomic Workforce Shocks in the Policy or Regulatory Space, Their Potential Impact on Statutory Missions, and Their Influence on Decisions**

<table>
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<tbody>
<tr>
<td></td>
<td></td>
<td>PWCS</td>
<td>DI</td>
<td>DR</td>
<td>Migrant Interdiction</td>
</tr>
<tr>
<td>Technology</td>
<td>A crippling cyberattack or geomagnetic storm demands a sophisticated response or reversion to backup systems.</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>A catastrophic Five Eyes intelligence failure leads to a major strategic shift to a mission lacking experience and expertise.</td>
<td>–</td>
<td>–</td>
<td>–</td>
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</tr>
<tr>
<td></td>
<td>A revolutionary computing breakthrough unleashes new C5I capabilities.</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

³ Decision Influence: A = Avoid, S = Seize

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<tbody>
<tr>
<td></td>
<td></td>
<td>PWCS</td>
<td>DI</td>
<td>DR</td>
</tr>
<tr>
<td>Socioeconomic</td>
<td>The collapse of the maritime EEZ and rule of law leads to a prolonged spike in IUU fishing across the globe. Demand for allied-country training missions and other international partners increases. A coastal region endures a prolonged economic recession or struggling storm recovery. A major public relations crisis for leadership results in less public trust and greater congressional scrutiny. Law enforcement and life safety missions (e.g., multimission first responders) undergo a fundamental restructuring.</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

NOTE: MS = marine safety. PWCS = ports, waterways, and coastal security. DR = defense readiness. MEP = marine environmental protection. – = negative effect on potential mission importance, demand, or budget. + = positive effect on potential mission importance, demand, or budget. A blank cell indicates no anticipated effect or mixed effects. X = a potential area of influence for decisionmakers. Five Eyes is a reference to an intelligence alliance between Australia, Canada, New Zealand, the United Kingdom, and the United States. EEZ = exclusive economic zone. IUU = illegal, unreported, and unregulated.

<sup>a</sup> We have borrowed this terminology from Lachman et al., 2013.
Multiple GNSSs have lost contact with several satellites, either from physical damage or potentially a denial-of-service attack of unknown origin, coupled with periodic spoofing. This outage is particularly problematic because the Coast Guard and international maritime community have embraced electronic navigation and eliminated many physical ATON during the past several decades. SAR platforms and systems, which had become more efficient thanks to creation of distress notification methods that utilize GNSSs to broadcast the locations of emergencies, reduced search in favor of greater rescue capabilities. Because of these technological changes, autonomous and aviation assets are inoperable or have dramatically restricted ranges. Even manned surface vessels struggle with routine procedures because shoreside timing signals are unreliable and shipboard transponder systems provide inaccurate or incomplete location information.
IO and law enforcement workforces have implemented strategies, policies, and regulations that allowed them to use GNSS and other remote or autonomous technologies to increase operational effectiveness and efficiency. As such, minimally crewed icebreakers in districts 1 and 9 are having difficulty in adhering to previously broken paths when visibility conditions are poor. Boardings of commercial fishing vessels in district 5, usually facilitated by machine learning–based anomaly-detection drones, have been hampered by erroneous data on relative ship locations; the Coast Guard is also having increased difficulty monitoring possible fishing in closed areas. Most dangerously, multiple accidents have already been associated with spoofing of precision navigation and transponder systems.

Beyond the Coast Guard, the additional workforce demands—especially with recent changes that have decreased the active-duty force while sizing up reserves—have dramatically increased the risk of a major collisions or groundings in busy waterways. A collision at the confluence of the Mississippi and Ohio Rivers at Cairo, Illinois, caused spillage of large amounts of oil and partial obstruction of the channel. Although vessels operating in rivers used to rely on visual navigation to mark the constantly shifting safe water, dynamic geofencing had rendered these aids unnecessary. Experts believe that pilot fatigue and a distracted visual lookout, in addition to jammed radio traffic, were responsible for the disaster.

Near the Port of Philadelphia, a liquefied natural gas tanker carrying shale gas supplies from Pennsylvania for export nearly collided with a container ship. If they had actually collided, the resulting fuel–air mixture could have subsequently exploded, causing large-scale loss of life, as well as considerable damage to nearby vessels, port and river infrastructure, and neighborhoods. As a result, the federal government has put a temporary halt on all natural gas imports and exports, causing fuel shortages in district 1 during a severe cold snap.30

Workforce Shock Narrative 2: Quarantine Quagmire

This shock narrative describes a second set of potential events and is compatible with all scenarios in the Workforce family. It focuses on the Coast Guard’s multimission first-response responsibilities being complicated by allied training missions.

In late winter and early spring, officials in Hong Kong are desperately working with the World Health Organization to identify the source of a new sickness that has hospitalized ten people, killing five of them. Laboratory tests confirm that this is a new type of flu, named avian influenza C (H3N9). Several critical water jet–propelled commercial cargo vessels left Hong

30 Sources for this narrative include that

DHS noted that from 2010 through 2012, “North Korea jammed GPS signals in South Korea numerous times for periods that lasted between 4 and 16 days, disrupting GPS receivers in many cell towers in addition to over one thousand aircraft and hundreds of ships. . . .” (Behr and Sobczak, 2015)

In addition, “over 90 incidents of GPS jamming [have been] reported by pilots through [the National Aeronautics and Space Administration’s] Aviation Safety Reporting System (ASRS) since 2013” (Buesnel and Holbrew, 2017, p. 5).
Kong before World Health Organization regulators could test crew members for H3N9, one of which, destined for the Ports of Los Angeles and Long Beach, made the crossing in six days. The disease is now established in southern California, with hundreds of people being hospitalized, as well as thousands of “worried well” who are seeking care. Quarantines have been imposed in select areas of Los Angeles, San Diego, and elsewhere.

Coast Guard personnel in the area are particularly concerned about their families being exposed, and some are struggling to fulfill their duties while keeping their children at home. Although the service would typically relocate families out of harm’s way, a federally imposed quarantine has limited movement in and out of the area. Despite these efforts, unconfirmed cases of the disease have been reported in other cities.

Adding to the challenge is that, three weeks after the illness was introduced in California, a wildfire has left many sections of San Diego ravaged, and hundreds of people who were under quarantine are now displaced. Although shelters have been set up, the government is unable to track where many formerly quarantined people have gone. Fire threat is high in Los Angeles and Ventura County.

At the same time, a new strain of the Middle East respiratory syndrome coronavirus (MERS-CoV) emerges in Dubai and initially spreads to surrounding countries via participants in a regional trade conference. It continues to spread and evolve throughout the Middle East, including to Saudi Arabia, the United Arab Emirates, Oman, Yemen, and North Africa (see Figures 4.4 and 4.5). U.S. Navy 5th Fleet reports sickness in local partners and service members alike, and many have been evacuated for treatment and as a precaution. Coast Guard assets located in the Persian Gulf and Indian Ocean have been retasked from allied training missions to antipiracy patrols, and crew members are nervous about being underequipped for an extended deployment as the security situation worsens.

Two months later, efforts at containing the Ebola virus to three small villages in Guinea fail as frightened people break the quarantine. Within weeks, the virus has spread up and down the west African coast (see Figure 4.5). Coast Guard assets have been sent to support the 5th Fleet. Two vessels that evaded patrols and left the Port of Conakry with refugees are now believed to be in the middle of the Atlantic bound for the U.S. East Coast but are not reporting their intentions or locations. Given the ongoing crisis, DHS is ramping up screening and search protocols at U.S. ports of entry.31

31 This shock was inspired by several reported cases of highly communicable diseases around the globe in 2014, including the Middle East respiratory syndrome coronavirus in Saudi Arabia, Turkey, Qatar, and Austria; Ebola in west African countries; and avian influenza in China and Hong Kong (World Health Organization, undated).
Figure 4.4. Map of Past Outbreaks of Middle East Respiratory Syndrome Coronavirus


Figure 4.5. Map of Past Ebola Outbreaks

SOURCE: Incident Management System Ebola Epidemiology Team et al., 2014.
The Asset Scenario Family

Objective 1.2 of *Coast Guard Strategic Plan: 2018–2022* (U.S. Coast Guard, 2018b) is to modernize assets, infrastructure, and mission platforms, which includes a focus on the continued acquisition and deployment of offshore patrol, polar security, and waterways commerce cutters. It also emphasizes moving beyond recapitalizing aging surface assets to prioritizing mission enablers, such as shoreside infrastructure and aircraft fleets. This will include heavy technological investment, including for C5I.

Two important dimensions of future change for assets, infrastructure, and mission platforms identified through HSOAC SME elicitation were (1) the pace of climate-linked changes that raise the likelihood and severity of acute shocks and (2) the rate of technological change and adoption. Although, for simplification in this discussion, we treat them as independent axes, both of these changes have some relationship to long-term energy, geoengineering, and climate adaptation efforts at the national or global scale.

Table 4.3 contains example stressors for each of these axes, and Figure 4.6 orients the four Asset family scenarios. There are several important assumptions related to this scenario family. We assumed that a rapid rate of technological change and adoption could result in the proliferation of autonomous systems and major advances in artificial intelligence and communication or networking for C5I. Meanwhile, an increasing pace of climate impacts could result in rapid acceleration of sea level rise, extensive sea-ice recession, and frequent extreme storm events. The potential levels of disorder in a world intensely affected by climate change (here, the Shocks and Struts and Things Go to Eleven scenarios) cause uncertainty as to whether the Coast Guard could rely on technological changes and adoption to ready the asset mix to fulfill Coast Guard missions. The scenarios in this family also reflect a great deal of uncertainty from exponential, self-reinforcing trends, such as technology adoption rates and climate mechanisms. For example, fully autonomous vehicles (AVs) could end up being a relatively niche technology, with other, more-popular alternatives emerging.
Table 4.3. Example Asset Scenario Dimensions and Their Stressors

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Stressor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rate of society’s adoption of technology</td>
<td>Expanding use of artificial intelligence and machine learning (efficiency gains and C5I applications)</td>
</tr>
<tr>
<td></td>
<td>Increasing use of unmanned vehicles and AVs (surface, underwater, and aerial)</td>
</tr>
<tr>
<td></td>
<td>Increasing use of data and communications (remote sensing and sensor networks)</td>
</tr>
<tr>
<td></td>
<td>Improving advanced materials and manufacturing (three-dimensional printing)</td>
</tr>
<tr>
<td></td>
<td>Increasing complexity of the supply chain (critical technology and resource vulnerabilities)</td>
</tr>
<tr>
<td>Pace of climate impacts</td>
<td>Changing weather patterns (flood and drought)</td>
</tr>
<tr>
<td></td>
<td>Increasing frequency or intensity of tropical storms (including a lengthened season)</td>
</tr>
<tr>
<td></td>
<td>Shifting shipping routes and increasing Arctic services</td>
</tr>
<tr>
<td></td>
<td>Increasing offshore energy-related activities (fossil fuels; alternatives, including sequestration; renewables)</td>
</tr>
</tbody>
</table>

Figure 4.6. The Asset Scenario Family

<table>
<thead>
<tr>
<th>Low</th>
<th>Pace of climate impacts</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rapid</td>
<td>1. Sensing a Pattern</td>
<td>2. Shocks and Struts</td>
</tr>
<tr>
<td>Slow</td>
<td>3. Humdrum Doldrums</td>
<td>4. Things Go to Eleven</td>
</tr>
</tbody>
</table>
Asset Scenario 1: Sensing a Pattern

Artificial intelligence is rampant, and advances are being made at an unprecedented rate in both the civilian and security sectors. Unmanned and autonomous vessels, vehicles, and robots greatly increase efficiency and can facilitate service-relevant tasks and functions, such as monitoring and inspection. Sensor networks, advanced materials, and additive manufacturing are available to revolutionize support functions. There are limited disruptions from climate change, in part because of new alternative energy technologies and improvements in traditional fossil fuel extraction and maritime transportation. Ecological stressors in this technocentric world are uneven, although the level of impact is not as high as people might have feared two decades prior. For example, some fisheries are experiencing stress at the same time as others are flourishing, inviting more interest in the U.S. EEZ and adjacent waters.

Asset Scenario 2: Shocks and Struts

There is a rapid rate of technological change and adoption, in which certain sectors are perceived as strutting (seemingly immune to impacts of climate and other factors that could dampen trends) while others are shocked, suffering enormous consequences from the higher pace of climate impacts. Although not all current technologies grow and mature as forecast in years prior, technology’s impact on society is high, and there are several additional unforeseen breakthroughs in realizing the mobile internet, automation of knowledge work, the internet of things, and advanced robotics. The high rate of adoption engenders trust by the general public. Human–machine collaboration is close to seamless, and machine learning techniques are used extensively to aid in routine decisionmaking. Resilient networking (data) and communication (e.g., voice, video) systems are essential for coordinating surge responses in degraded operational environments in the wake of disasters and in tense geopolitical situations. The complexity of supply chains to support these technological innovations are vulnerable to climate and climate-related disruptions.

Asset Scenario 3: Humdrum Doldrums

In a world characterized by a low pace of climate impacts and slow rate of change in technology, the U.S. government alternates between stimulus projects and austerity. This leads to incomplete infrastructure-related projects. Investment in information systems and defense against cyber threats is inconsistent. The pace of technological change has slowed across sectors, but the offerings from the commercial sector remain far advanced compared with security-sector technology. Even though the worst of climate change predictions have not come to pass, there are unavoidable major shifts in Arctic sea-ice surface area. Without substantial new technologies and investments, maritime domain awareness and navigation in the still-frigid Arctic waters remain challenging. There are increasing reports of Arctic maritime safety incidents.
Asset Scenario 4: Things Go to Eleven

Extreme climate change impacts lead to more-frequent and -severe shocks. The rate of technological progress and adoption is low, exacerbating climate change impacts, such as a lengthened tropical storm season and shifting shipping routes in the Arctic. More-frequent or more-powerful storms also degrade infrastructure. Heat stress becomes an increasingly important public safety factor and contributes to intensifying demand for emergency care and rescue. Oil and gas extraction activities continue in the absence of technologies to enhance alternative or renewable energy production. Energy production and transportation become more physically and environmentally hazardous because of lack of consistent investments (including repairs) in infrastructure and a relatively loose regulatory environment. Recent increases in the frequency and severity of hurricanes and floods have failed to tip the balance toward more-conservative fuel extraction practices.

Asset Scenario Family Shock Examples

During HSOAC internal workshops, SMEs suggested that technology- and policy- or regulatory-based shocks would have the most impact in the context of the Asset scenario family. Table 4.4 lists relevant shock examples and maps them to relevant Coast Guard statutory missions. It also generally includes possible Coast Guard decision relevance. These shocks could take place against the background of any of the four scenarios outlined here, although some would be more relevant than others, and could lead to a greater likelihood of shocks reoccurring or being more severe. For example, if the Coast Guard experienced a higher pace of climate impacts and faster rate of technological change and adoption, those could lead the service to address new harbors and cargoes or major innovation in landside logistics.

Here are two examples of specific shock narratives that could be associated with this scenario family.

Asset Shock Narrative 1: Oil and Water Don’t Mix

This potential shock would test the boundaries of changes in boat design, new harbors and cargoes, and a dramatic shift in energy policy—as a result, it is compatible with Shocks and Struts and Things Go to Eleven. After a period of prolonged political instability, Russia invests in Venezuelan energy and shipping infrastructure, increasing oil production and alleviating port congestion. On older, loaned Russian tankers, the majority of the oil is bound for Russia and China, with the Philippines, Vietnam, and Indonesia also purchasing large percentages to continue their quantum computer manufacturing–led economic growth.
Table 4.4. Selected Technology and Policy or Regulatory Asset Shocks Based on the Economic Environment, Their Potential Impact on Statutory Missions, and Their Influence on Decisions

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<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>Technology</td>
<td>Boat design (e.g., speed, endurance, autonomy, capacity) changes dramatically.</td>
<td>PWCS DR Interdiction OLE</td>
<td>ATON SAR LMR MS MEP IO</td>
<td>Avoid Future Harm to Operations Avoid High Future Costs Meet Future Requirements Seize an Opportunity for Benefits</td>
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<tr>
<td></td>
<td>There is major innovation in landside logistics or the opening of new harbors to new cargoes.</td>
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</tbody>
</table>

Notes:

<sup>a</sup> Consideration of opportunities for benefits.
<table>
<thead>
<tr>
<th>Trend</th>
<th>Shock</th>
<th>Statutory Mission Impact</th>
<th>Decision Influence&lt;sup&gt;a&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy or regulatory</td>
<td>A domestic national debt crisis requires austerity policies.</td>
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<td></td>
<td>Energy policy shifts suddenly away from fossil fuels.</td>
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<tr>
<td></td>
<td>There is a shock to a trade network or alliances (Central America sanctions).</td>
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<td></td>
<td>There is a ban on destructive fishing gear or a freeze on oil exploration.</td>
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<tr>
<td></td>
<td>Foreign-imposed critical-resource embargo (rare-earth metals needed for computing or alternative energy tech)</td>
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<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> We have borrowed this terminology from Lachman et al., 2013.
After a series of powerful hurricanes brings the U.S. production, refining, and storage system along the Gulf of Mexico to its knees, the United States is forced to relent on a United Nations-sanctioned embargo of Venezuelan oil exports, admitting geopolitical weakness in the face of unsolved energy and climate challenges. Coast Guard assets and infrastructure from Texas to Florida were similarly pummeled and struggle to keep up with the influx of port recovery inspections and additional bulk cargo traffic.

Russia senses a strategic opening in the Arctic while DoD and DHS attention is necessarily elsewhere. Dual-purpose resource extraction infrastructure in remote areas has been used to host Russian naval vessels and intelligence-collection assets. Russian shipping activity has increased in the Barents Sea and elsewhere in the Arctic as the Northern Sea Route becomes an increasingly economically and strategically important route.

Russia has encouraged allied countries and their aging, unhardened fleet vessels to use its Northern Sea Route, albeit escorted by heavy, armed icebreakers (see Figure 4.7). Not all nations adhere to the safety requirements needed to transit the route, and multiple ships have spilled oil in the Arctic. With a spike in oil prices, the Russians have been unable to keep pace with escorts, and a nonhardened vessel tried to transit the Arctic and collided with a late-season iceberg in Russia’s territorial waters, just 25 nautical miles from the border of U.S. territorial water. Unfortunately, several of the polar security cutters in district 17 that would otherwise be available for duty either are in a midlife overhaul or have been retasked to district 8 in the Gulf of Mexico to assist with hurricane recovery.

Fortunately, the long-planned DHS coastal observation network—a constellation of unmanned ground and airborne sensors along with a batch of small satellites—reaches initial operating capability for a pilot region along the Gulf Coast. This network is intended to support hurricane recovery efforts. Independent analysts using machine learning anomaly-detection software observe what appears to be new transshipment smuggling operations near the new deepwater port at Cameron, Louisiana, where most of the Venezuelan oil tankers dock. When the Coast Guard attempts to board the vessel, several crew members under the effects of gamma-9, a new synthetic drug associated with hallucinations and violence, repel the party, leading to a leaking hull and an as-yet-unresolved diplomatic standoff.32

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32 We were inspired for this fact pattern by various news articles on Russian interests in Venezuela, a 2018 oil tanker collision off the coast of China, the expected expansion of U.S. Gulf Coast port infrastructure, and data from the U.S. Energy Information Administration.
In late spring, a massive earthquake tragically hits central Mexico, just south of the capital, causing widespread destruction (see Figure 4.8). Fatalities are expected to number in the thousands, while hundreds of thousands of people have fled their homes and the ensuing insecurity. Most of the affected region lacks electricity and clean water, while parts of the region lack sufficient food supplies or the surviving infrastructure to receive them via commercial deliveries. Like in previous episodes of political and climate-related mass migrations from Latin America, a caravan of displaced people are aspiring to seek aid by heading to various points along the U.S. border, except that, this time, it is an order of magnitude larger with much less
advance notice than before. DHS is charged with responding to the humanitarian and immigration crisis, but the Coast Guard does not have enough air, land, or sea assets in the area to provide direct operational or indirect logistical support, curtailing important missions in other districts and surge responses to other severe weather–related crises.

Figure 4.8. A Map of a Catastrophic Earthquake in Central Mexico

![Map of a Catastrophic Earthquake in Central Mexico](image)


Complicating matters is that this disaster comes at a time when the Mexican government appears to be on the verge of collapse, which hinders recovery efforts. TCOs have been increasingly able to control large areas of the country to the exclusion of Mexican federal authorities—there are some parallels to the Revolutionary Armed Forces of Colombia from 1964 to 2017. The TCOs have openly published rewards for the murder of top government and law enforcement officials who opposed organized crime. This morning, the most vocal judge who opposed the TCOs was publicly tortured and executed, along with his family.

The president of Mexico scheduled a televised appearance this evening, and there is great uncertainty whether there is any truth to the rumor is that the administration intends to step down immediately and depart the country before warlords or heavily armed TCOs seize key buildings in the capital. At this point, the military still appears to be capable and loyal to the president and
the party, although using force could trigger actions similar to those in Canada’s October Crisis of 1970 in Montréal, responding to the assassination of Deputy Premier Pierre Laporte, suppressing the Front Libération du Québec, and suspending habeas corpus. Parts of Mexico have descended into de facto civil wars with the TCOs and independently commanded and controlled parts of the military still loyal to government.

For the Coast Guard, the breakdown of federal authority in Mexico could present several challenges, including increased drug and other contraband flows from or via Mexico to the United States; large numbers of Mexican emigrants entering the United States via sea without authorization, many of whom might require rescue to avoid drowning on makeshift vessels; Mexican fishermen showing fewer inhibitions about fishing illegally in the U.S. EEZ as their own fisheries break down from lack of regulation; and piracy of U.S. vessels and ship traffic near the maritime border. Mexican TCOs might also become more aggressive in the face of the Coast Guard and OLE, requiring greater asset deployment and sophisticated personnel training. Some have even been emboldened to conduct, albeit thwarted, seaborne attacks against U.S.-flagged vessels and domestic port facilities, even if only for symbolic value.

Although the service stood ready to the challenge, assets have suffered irreparable damage, specially trained forces are greatly fatigued, and the leadership is considering how best to stage the months-long recovery from the surge in the face of an upcoming hurricane season. Congress has already called for hearings into whether the law enforcement (as opposed to the humanitarian) response was adequate and justified under U.S. and international law.\(^{33}\)

### Common Resource Allocation and Distribution Considerations

In our internal workshops, HSOAC SMEs identified several stressors that applied to both the Workforce and Asset scenario families. Through continued analysis, in the third workshop, we consolidated several of these stressors into two change variables: (1) the level of budget and extent of mandate or authority and (2) the spatial and temporal alignment of resources. Table 4.5 and Figure 4.9 summarize this additional family. We do not consider these scenarios but rather considerations or constraints. However, we found it useful to employ the 2×2 framework for representing these considerations because there are alternative ways to think about their impacts.

\(^{33}\) This shock was inspired by the rise of gangs in the United States, sustained violence in Latin America and the Caribbean (including Mexico), the Pancho Villa raid in 1917, the collapse of Somalia contributing to piracy, and the two massive earthquakes that hit central Mexico in 2017 (magnitudes 8.1 and 7.1 within two weeks of each other).
Table 4.5. Example Resource Consideration Dimensions and Their Stressors

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Stress</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource alignment</td>
<td>Increasing volumes and complexities of trade (port agglomeration, coastal lightering, and transshipment)</td>
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<td></td>
<td>Greater strategic emphasis on flexible mobile platforms and resilient fixed infrastructure</td>
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<tr>
<td></td>
<td>Growing concerns about the mismatch between mission demands and the supply of people and resources at the district level (potential Arctic vulnerabilities and capability gaps)</td>
</tr>
<tr>
<td>Budget or authority</td>
<td>Accelerating cycle times for information and equipment</td>
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<tr>
<td></td>
<td>Increasingly complicated trade-offs between data management, validation, protection, and integration</td>
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<td></td>
<td>Rapidly shifting executive and legislative branch priorities and budget requests and appropriations</td>
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</tbody>
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Figure 4.9. Potential Resource Allocation and Distribution Worlds

In the past decade, there have been some noticeable trends in the Coast Guard’s budget priorities (see Table 4.6). For example, in the early 2010s, the Coast Guard focused on rebuilding and recapitalizing assets; in the middle of the time period of our analysis, it emphasized stewardship and partnering. These ambitions reflect not only internal strategic decisions but also, and more importantly for this exercise, externally imposed secular and cyclical trends. For example, several decades after a major political or economic shift, the current commandant will need to address aging assets. Similarly, after major shocks, Congress might take a renewed interest in preparation, supplanting longer-term priorities. In times of budgetary stress, the Coast
Guard might explore partnership opportunities or other sources of optimizing efficiency. Last, major investment initiatives are necessarily followed by recapitalization to maintain the readiness and agility of the workforce and assets.

<table>
<thead>
<tr>
<th>Financial Year</th>
<th>Build, Invest, and Enhance</th>
<th>Maximize, Optimize, and Modernize</th>
<th>Sustain and Preserve</th>
<th>Steward, Support, and Partner</th>
<th>Rebuild and Recapitalize</th>
<th>Prepare</th>
</tr>
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<tbody>
<tr>
<td>2020</td>
<td>x</td>
<td>x</td>
<td>x</td>
<td></td>
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<td>x</td>
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<td>2019</td>
<td>x</td>
<td>x</td>
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<td>2018</td>
<td>x</td>
<td>x</td>
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<td>2017</td>
<td>x</td>
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<td>2016</td>
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<td>2015</td>
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<td>2014</td>
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<td>x</td>
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<tr>
<td>2013</td>
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<td>2012</td>
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<tr>
<td>2011</td>
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<td>2010</td>
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</table>

**SOURCE:** Annual Coast Guard budgets in brief.
**NOTE:** We based each column heading on the predicate of one of the priorities.

In addition to the Coast Guard’s first STRAP being to maximize readiness today and tomorrow, other STRAPs for the service are to address the nation’s complex maritime challenges and deliver mission excellence anytime, anywhere. This is necessarily a balancing act with limited resources and spatial and temporal allocation decisions. As shown in Figure 4.10, the requested budget is sometimes in alignment with Congress’s appropriations and, at other times, deviates quite substantially (nearly 10 percent of the total, in some cases). Although the Coast Guard does not budget by mission, it can model budget impacts on its statutory obligations. PWCS, DI, and migrant interdiction fluctuate the most.

The year-over-year changes could have long-term effects on other objectives in *Coast Guard Strategic Plan: 2018–2022* (U.S. Coast Guard, 2018b), including

- 2.1, to strengthen maritime governance
- 2.2, to enhance the unified effort
- 3.1, to strengthen resilience through crisis leadership, emergency preparedness, and surge response
- 3.2, to innovate for better organizational performance.
Although it was beyond the scope of this project to develop scenarios and shocks for these objectives, we do elaborate on how these could be reflected in common resource allocation and distribution considerations, as described in alternative sets of assumptions in the rest of this chapter.

Common Consideration 1: Smooth Sailing

In this ideal future world of abundant and well-aligned resources available to the Coast Guard, the service is well integrated with DHS and is frequently deployed in support of defense, training, and humanitarian missions. The Coast Guard also works seamlessly with NOAA and the Maritime Administration on not only the maritime transportation system (MTS) but also in providing situational awareness and effective interdiction for the LMR, MEP, and OLE missions. The Coast Guard is a leader in demonstrating the application of universal standards and regimes, information that is readily transferred to partners at all levels during capacity-building exercises. The Coast Guard has cultivated crisis leadership throughout the service, and every crew member is able to effectively and efficiently execute their duties no matter the time, place, or situation.
Common Consideration 2: Ebb and Flow

A shifting external risk and threat environment means that times are changing for the Coast Guard. In the face of a massive resource alignment, federally funded research and development centers, national labs, and management consultants have put forth a plan for a new, strong sense of direction. Powerful backers in Congress, other DHS components, and the DoD services see the Coast Guard as an innovator and bestow ample budget and authority on the service.

Politicians and administrators want the Coast Guard to become nimbler and more adaptable. One potential path for consideration is shifting much of the service’s duties for the MTS to private industry. In addition, to reduce demand on its own overtaxed resources, the Coast Guard helps fund additional capacity in partners at all levels. Congress is keen to see returns on investment, especially through such missions as DI and migrant interdiction. Assets that provide enhanced situational resources are owned and maintained by the Coast Guard but are jointly operated by all DHS components.

Common Consideration 3: Choppy Waters

The Coast Guard finds itself in a future world of lower budgets and authority coupled with weak resource alignment. Repeated calls for rebuilding and recapitalizing have remained underfunded. This results in low levels of defense interoperability and growing redundancies in assets. The Coast Guard is reliant on C5I platforms built and maintained by others. The MTS becomes uncoordinated and underregulated.

Common Consideration 4: Hurry Up and Wait

Prior investments in strong analytic tools for risk and decisionmaking continue to pay dividends by allowing the Coast Guard to maintain a robust resource presence despite recent lower budget allocations. The Coast Guard remains well integrated with DHS and DoD. However, the service’s role is largely to support other U.S. government agencies. It maintains extensive partnerships but lacks the ability to invest in new technologies or capabilities. Workforce burnout becomes rampant.
5. Findings and Conclusions

The Coast Guard faces the enormous planning challenge of an uncertain future operating environment. The service has myriad responsibilities and is expected to carry out a variety of missions anywhere in its many areas of operation. Changes in the operating environment—physical, technological, economic, geopolitical and international security, policy and regulatory, or social—will influence not only the demand for particular types of Coast Guard missions but also the service’s ability to supply them. For example, the confluence of changes in climate, the science of synthetic drugs, shipping materials and practices, and social factors related to drug demand could lead to changes in the Coast Guard’s level and geographic distribution of effort for DI. Similarly, increasing seasonal maritime access and elevated economic opportunities in the Arctic could result in greater demand for Coast Guard SAR and environmental response in this region. Not only do such changes influence external demands on the Coast Guard; they also bear weight on the service’s human resources, materiel assets, and infrastructure. In other words, potential future changes operating at a global scale shape and perturb the Coast Guard’s supply of services at the same time as they are influencing demand through changes in the operating environment.\footnote{The same social patterns and demographic trends that broadly help shape demand for Coast Guard missions will also shape the composition of the service itself. Similarly, the climate and environmental changes that drive demand for Coast Guard missions will also influence the resilience of Coast Guard facilities. The technologies that bad actors use to stealthily transport drugs or traffic humans could also provide important capabilities to the Coast Guard for its missions.}

For the past two decades or so, Evergreen has provided the Coast Guard with opportunities to consider longer-term future changes and their potential impacts on the effectiveness of near-term decisions. As the world and Coast Guard have changed, these strategic foresight activities have also evolved to meet new demands. Now in the fifth iteration of its multiyear investigative process, Evergreen is once again considering how to generate scenarios that help foster analysis to support Coast Guard strategy making and planning. This report has summarized an updated approach for generating decision-relevant global planning scenarios and examples of scenario narratives derived using these methods. The \textbf{main advance here is threefold:}

\begin{itemize}
  \item the introduction of a structured approach for articulating and categorizing mission-relevant change drivers
  \item a technique for examining selected drivers in the context of scenario families where pressure can be further increased by the introduction of shocks
  \item a set of starting scenarios ready to support decision analysis for some aspects of Coast Guard readiness
\end{itemize}
Importantly, these advances set Evergreen up to conduct analysis using DMDU approaches, which emphasize decision relevance and links between potential future problems and actions that need to be taken between now and then. In Van Abel, Wilson, and Anania, unpublished, we made a detailed proposal for an analytic process implementation approach.

A Review of Our Findings

In Chapter 2, we summarized two analyses we conducted to help guide our proposed scenario development process (this also motivates the approach for conducting scenario-based analysis discussed in Van Abel, Wilson, and Anania, unpublished). The first analysis was a compilation of lessons from prior Evergreen activities that helped us identify what has historically been valuable and what could be improved in the future. Three primary points stood out for the purposes of shaping scenarios and the way they are created: (1) Generally speaking, Evergreen participants find the experience of considering the implications of longer-range future scenarios for Coast Guard operations valuable; (2) scenarios and foresight activities are not always or entirely successful at enabling deliberation of important trade-offs related to hard problems; and (3) users struggle to incorporate Evergreen products into their planning and decisionmaking processes, and it is difficult to trace potential impacts of Evergreen.

The second analysis we did to guide scenario construction, focus, and content was to map, at a low level of granularity, the purpose, inputs, and outputs of Coast Guard PPBE and the service’s strategic library. The scenario-relevant findings from this included an identification of potential needs for continued or additional decision support from Evergreen analyses, which is important for focusing the content of scenarios. The lack of a robust bridge between slow-burning or emerging future problems and decision points in the near term represents both a challenge and an opportunity for Evergreen and speaks to the need for scenarios that enable discussion of trade-offs relevant in the near term even if the motivating problems might be longer range. Finally, this examination also helped identify some stressors and shocks less densely covered in strategies, which can form important scenario inputs to stress-test current plans.

This report proposed three concepts that are central to the updated approach for structuring and generating Evergreen scenarios. The first is that scenarios should be framed by the decisions they are intended to support. The second is the use of a stressors-and-shocks framework (Chapter 3), which has its conceptual roots in a large body of academic and applied resilience work. This framework is intended to articulate and organize mission-relevant drivers of change. This framework curates the content for scenarios, which can be compiled in a modular fashion depending on the focus of decisions to be supported. The third concept is that of the scenario family (Chapter 4), which is related to several approaches in scenario-based planning methods. This concept enables creation of alternative futures that can stimulate deliberation among trade-offs. Leveraging the concepts of decision framing, the stressors-and-shocks framework, and the
scenario family approach, we presented example scenario narratives (Chapter 4) relevant to future Coast Guard readiness. These families contain modular narratives that, in some cases (when presenting consistent future trend patterns), can be combined to form richer, more complex scenarios. Various types of compatible shocks can be employed to present additional challenges and, in particular, simulate the tension between day-to-day demands resulting from stressors with sudden resource-consuming perturbations.

**Conclusion**

A variety of ongoing and emerging trends and other drivers of change affect the Coast Guard, and not uniquely. However, current planning mechanisms that drive decisions do not robustly weigh future change with near-term considerations. Evergreen could produce outputs to more directly support planning in the Coast Guard PPBE process and help stress-test particular strategies, among other applications. Having good scenarios and a robust, repeatable process for generating them is a starting point for this future success.

The fundamental rationale underpinning the approach proposed in this report is that meaningful scenarios are defined by how they will be used. The specific decisionmaking context they are intended to support guides the content of the scenarios. Scenarios are in the service of the decisions they are intended to support and should reflect the decisionmaking and strategic foresight processes for which they will be used. Thus, we place great emphasis in this report on describing the approach and framework for generating and using global planning scenarios in addition to providing examples of scenarios. The approach we used explicitly discourages constructing scenarios based on hot topics alone or allowing the activity of foresight to drive what decisionmaking is supported and how.

The Coast Guard can take better advantage of its existing capabilities for scenario-based analysis. Furthermore, Evergreen strategic foresight efforts can be made more targeted and relevant for Coast Guard planning. Without weighing the long view of changes in the operating environment alongside current or nearer-term demands, the Coast Guard will not be able to have full awareness of what blind spots might exist. The service’s motto—*Semper Paratus*—implies readiness for anything. Fulfilling that promise requires mindfulness of both the near and long terms and how change will affect the Coast Guard.
Appendix A. Full-Length Exemplar Scenario Narratives Used as the Basis for Evergreen Activities in Fiscal Years 2019 and 2020

This appendix contains full-length examples of Evergreen scenario narratives that were employed as a foundation for Evergreen foresight activities in FYs 2019 and 2020. These narratives come specifically from the materials given to participants at an Evergreen workshop conducted at the Fall 2019 Maritime Risk Symposium at the State University of New York (Maritime). What follows are narratives for each of four alternative futures that were constructed based on the intersection of multiple trends, including climate warming and other physical environment changes, shifting geopolitical patterns, evolving multisector global economy, technological shifts, and different demographic directions. The framing decision context for these was fashioned by HSOAC because there was not an overarching theme to the Evergreen events in FYs 2019 and 2020 and there was a desire to support multiple potential decisions within the broader context of potential future change. Thus, HSOAC framed scenario generation around a fictional broad situation in which a future Coast Guard is implicated in a U.S. government reorganization. The question is, how should the Coast Guard be realigned, given its evolving mission sets? The hidden assumption behind each of the scenario narratives that follows is that the Coast Guard’s organizational position within the U.S. government and associated mission emphasis have evolved in one of the following ways:

- hazards and disaster recovery focus (closer alignment with the Federal Emergency Management Agency)
- border and security emphasis (closer alignment with Customs and Border Protection)
- diplomacy (realignment within the Department of State)
- defense (realignment within the Department of Defense).

We now reproduce the scenarios verbatim.

Future 1

Future Scenarios

US Coast Guard Evergreen V
Maritime Risk Symposium Workshop

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35 These scenarios were generated by HSOAC-RAND in support of the U.S. Coast Guard’s Project Evergreen V. This is not a forecast, but one of many plausible potential futures. It was developed by combining major drivers of change, and imagining their potential interactions and outcomes. Last updated August 2019.
Today is September 10th, 2030. A lot has changed in the last decade:

China’s maritime infrastructure investments, including large ports and investments in international canal widening have continued to spread within the Indo-Pacific region. Billed as the maritime “silk road,” investments to create
access to ports (in Myanmar, Pakistan, Sri Lanka, and Djibouti, among others) and other infrastructure running from the Chinese mainland to East Africa has expanded to include additional infrastructure in and around the South China Sea (including in Cambodia, the Philippines, and Malaysia). Often called the maritime “silk highway,” these ports have become heavily dependent economically on China, which provides up to 80 percent of their activity. While China’s use of these ports remains exclusively commercial, some shipments are escorted at times by military vessels when crossing through areas prone to piracy. This has provided China with the justification it needs for establishing an ongoing naval presence throughout Asia, including established bases in multiple nations. These developments have raised tensions with the U.S. and its allies in the region because of the belief that the Chinese may be using this as a mechanism to gain further military control over key maritime shipping routes. Regardless of Chinese intent, this activity has increased the number of unplanned encounters between U.S. and Chinese Naval and commercial vessels.

Meanwhile, Russia has continued partnering with China to link increasingly productive oil and gas fields in the Sea of Okhotsk to the maritime silk road. Fearing the loss of its principal market for exports, Australia cautiously agreed to allow Chinese-funded expansions of port infrastructure at Darwin and Broome. A deal struck between the state of California and the Chinese government began making its way through U.S. Federal courts in 2027. The agreement would enable the Chinese to pay for green upgrades to the Ports of Long Beach, Los Angeles, Richmond, and Oakland in exchange for access to the same technology for developing and upgrading China’s yet undisclosed expansions to the maritime silk highway.

Maritime trade has accelerated within and through the Indo-Pacific. The proliferation of real-time business analytics, human-assisted machine decisionmaking, robotics, and commercial drones has multiplied the timeliness and efficiency of maritime transport for just-in-time manufacturing. Maritime vessel traffic (increasingly autonomous) in the region has doubled, including oil tankers and cargo vessels going through the Strait of Malacca.

India has become increasingly concerned about encirclement by China and its partners. A number of prospective commercial deals between India and China have fallen through after India claims in 2025 that the terms of the deals are unfair and
that China wrongly believes India is its “junior partner” in the region. The Chinese government has immediately responded by limiting exports to India – especially telephones, broadcasting equipment, semiconductor devices, computers, car parts, electric batteries, and a number of components important for leveraging automation. India publicly accuses China of trying to throw the world’s most populous country (which it became in 2026) back into the analog ages. India is also experiencing a rise in Hindu nationalism that increasingly makes Indian Muslims nervous, and threatens the country’s internal stability.

Japan, for its part, has been intensely angered by China’s increasing aggression in its claim over the Senkaku Islands through the course of the last decade. There were several incidents in the mid-2020s between the People’s Liberation Army Navy and the Japanese Maritime Self-Defense Force that might have escalated if the U.S. and Russia had not stepped in to provide diplomatic support. Finally, in 2029, the Japanese government decided to amend Article 9 of the Japanese Constitution, now fully abandoning its tradition of pacifism since 1947. The U.S. has continued advising and assisting Japan in building up its maritime forces, including a power-projection navy and air force. This has concerned some Japanese, and has greatly angered South Korea, China, and North Korea. The U.S.-South Korean alliance is frayed, and Seoul has begun reaching out more to Beijing.

The Chinese Navy began consistently patrolling near the Strait of Malacca after a large intensification of piracy incidents from 2022-2023. According to Chinese media posts, this was to promote safety and stability. Autonomous sentiment analysis of thousands of Malaysians and Indonesians suggested widespread support for these patrols. This, and fear of losing Chinese infrastructure funding (which also includes telecommunications), has prompted the governments of these respective countries to tacitly accept this military ramp-up.

The Chinese government has used the same justification to enhance its maritime presence in the Indian Ocean starting in 2023, particularly near the Bay of Bengal, which witnessed a dramatic rise in piracy starting in 2025 following China’s export squeeze on India. China has accused the Indian Navy of harassing Chinese flagged cargo ships bound for ports in Europe and African countries. Purchasing power in Africa has slowly started to increase for some countries. This combined with large populations in Nigeria, Ethiopia, Egypt, and the Democratic
Republic of the Congo particularly, has started to create small, lucrative markets for Chinese exports.

The U.S. has agreed with India that China has steadily been chipping away at other countries’ sovereignty in the region. The U.S. also takes exception to China’s implication that California is looking west to become part of the “maritime silk highway.” The U.S. Navy has begun stepping up security patrols in international waters off the coasts of Somalia, Yemen, Pakistan, India, Myanmar, Thailand, as well as by the Strait of Malacca. This quickly threatens to squeeze the service’s resources, which have also been dedicated to patrolling distributed U.S. Marine Corps expeditionary locations in the Philippines and Vietnam. Agents of the Chinese government are believed to have broached security at these remote locations. Increased maritime vessel traffic and reliance on autonomy for shipping has also led U.S. forces abroad to participate in search and rescue and environmental cleanups. In some cases, the Navy itself is involved with the incidents.

China has also increased its Antarctic presence with icebreaker patrols and an expanded series of Antarctic research stations. The Chinese icebreaker fleet is now ten vessels strong, of which six are devoted to southern Hemisphere operations. China has released an Antarctic strategy laying the foundations for claiming resources, land, and maritime shipping lanes over the next fifty years. Despite persistent sea ice, China has argued that the Antarctic should be open for business and pursues new technologies that could enable the beginning of new resource extraction activities.

U.S. diplomatic bargaining power has become somewhat hampered by the economic reality that U.S. national debt to China is increasing. Global markets experienced substantial volatility from 2024-2027 as China threatens on-and-off to sell a substantial portion of its U.S. treasuries. The U.S. feared an economic downturn, especially since growth has been stagnant in part because of the total government debt, which now looms at a record 120% of the Gross Domestic Product. Although China has managed to find new markets for exports throughout southeast Asia and into Africa it still needs the U.S. to import its goods, and thus ultimately stops short of a large sell-off of U.S. treasuries.
Large military expenditures, intended to counter rising China and address instability elsewhere, have fueled the increase in U.S. debt. Austerity measures such as rolling back healthcare and social services spending have become important issues ahead of the 2032 presidential election. In particular, Medicare, Medicaid, and Veteran healthcare spending face deep potential cuts. In addition, people with insurance through their employers and the self-insured have begun paying much more out of their own pockets. The desire for better health-care coverage becomes a major determinant in people's career decisions.

To the surprise of demographers, the U.S. population has begun growing younger, reversing the aging population of previous decades. This was due to two factors: a vast increase in immigration levels in the early 2020s—primarily of young adults, some of whom are coming with children—and a baby boom among millennials and Generation Z, reflecting the fact that childcare became free from birth onwards in 2022, funded by the federal government. The result is that U.S. population growth has grown faster than it had for decades, and immigration has swelled the ranks of the workforce. The percentage of the population that is employed has begun to grow. Recent social movements have enhanced digital privacy and cut back on drug legalization, which is highly unpopular with many young immigrant communities.

Most economic opportunities and services continue to be based in urban areas, which have become increasingly populated as rural areas further de-populate. Urban hospitals have struggled to meet the needs of growing populations. Part of this is because younger people desire to live longer and thus take care of their health in the near-term. Some immigrant communities have come from countries with poor healthcare systems and thus have many pre-existing health conditions. U.S. spending on healthcare has increased, though this is secondary in budget terms to the astronomical growth in military expenditures. There are increasingly partisan political discussions over the value a single-payer healthcare system would add.

At a time of perceived national vulnerability, many young adults have become interested in joining military services to contribute to their country. Service careers have also gained attractiveness for their longevity in a world where temporary work is increasingly viewed as too risky. Additionally, the cost of education has continued to increase, so many parents whose children attend
universities want them to choose high-earning career paths to recoup the costs of their educations. However, a large percentage of young people have been sufficiently deterred by the high cost of universities that they are seeking alternative educational credentials, such as “IT bootcamps” and massive online courses (MOOCs). The result is that many universities have closed.

U.S. maritime installations have begun flooding with greater frequency. Hurricanes in 2023, 2025, and 2026 produced record damage in southeastern Texas (including Houston), southern Louisiana, and Virginia, respectively. The Ports of Los Angeles and Long Beach ceased operations for a week during January 2028 during the most intense El Niño since 1982-83 caused record rainfalls and elevated sea levels and temperatures. Security has been largely automated at port facilities, with use of biometrics fully replacing Transportation Worker Identify Cards (TWIC) for the human employees at ports. Paperless bills of lading are on the rise; ports like Los Angeles-Long Beach, New York-New Jersey, and Boston are experimenting with digital ledger formats.

Biometrics have also advanced to a state where they can be used to identify intoxication with remarkable accuracy (90% probability of detection with only 2% false alarm rate). Public places and facilities such as ports have increasingly installed surveillance upgrades that enable security personnel to identify intoxicated individuals before they engage in disorderly conduct. Scientists predict that this type of technology will be available to law enforcement to help cue action when actors display malicious intent. Surveys suggest that the general public is embracing this type of surveillance activity as a means for enhancing security in cities that continue to grow.

Acidification of the oceans has reached a point at which it is degrading shellfish populations and having repercussions up the food chain. Moreover, there are indications that increasingly acidic waters are accelerating the rates of degradation of underwater infrastructure.

Here are some of today’s news headlines:

- U.S. and Chinese patrol boats nearly collide in the Bay of Bengal
- Natural gas from the Sea of Okhotsk is now flowing at capacity through the Maritime Silk Road
• Nigeria’s growth doesn’t seem to be stopping – who will get the economic advantage?
• California insists its new deal with China is legal
• How the Port of Houston is bouncing back on this seventh anniversary of Hurricane Margot
• National debt burden at all-time high
• The University of California at Merced and California State University at Dominguez Hills declare bankruptcy, the latest of dozens of institutions to close their doors
• Scientists say biometrics will leverage micro-expressions to increase security in cities and around critical infrastructure
Global Map of Scenario 1. China’s Maritime Silk Road and its potential expansion to the West Coast and Australia prompts a robust US security presence and willingness to intervene across the globe. It also contributes to prosperity across the African continent. There are some natural disasters and foreign-influenced protests disrupting the Americas.
Regional Map of Scenario 1. India is anxious about being encircled by Chinese influences, but US patrols off Somalia, Djibouti, Thailand, Vietnam, and the Philippines blunt that advantage. In several places, such as Karachi, Pakistan; Colombo, Sri Lanka; and Singapore, as well as other island chains the US forces come into frequent contact with Chinese counterparts.
Global Map of Scenario 4. The Russians have firm control over the Northern Sea Route with a declining US armed presence in the Middle East. Numerous economic and environmental innovations are occurring in Asia and the Indian Subcontinent. There are numerous natural hazard disruptions in the continental US, including coastal flooding and tornados. The Chinese sphere of influence has expanded to Mexico and Antarctic region.
Future Scenarios

US Coast Guard Evergreen V
Maritime Risk Symposium Workshop
November 14-15, 2019
SUNY Maritime College, The Bronx, NY

Scenario 2: Steady Growth

Image source (clockwise from top right):
Tomasz Wyszoamirski/Fotalia

36 These scenarios were generated by HSOAC-RAND in support of the U.S. Coast Guard’s Project Evergreen V. This is not a forecast, but one of many plausible potential futures. It was developed by combining major drivers of change, and imagining their potential interactions and outcomes. Last updated August 2019.
2: Steady Growth

Today is September 10th, 2030. A lot has changed in the last decade:

The U.S. has entered a stable period of economic prosperity, sustained by a strong U.S. presence abroad and U.S. commitment to alliances—particularly NATO—and partnerships. Strong global demand for oil and gas, intense Arctic ice melt, and improvements in deep sea drilling technologies have improved the economic viability of hydrocarbon fields under the Arctic Ocean. All five Arctic Ocean-adjacent states – Canada, Denmark (via Greenland), Norway, Russia, and the U.S. – have agreed through diplomatic discussions that cooperation between them helps all stakeholders gain the most from this economic windfall. China’s interest in the Arctic has not abated. However, China has been obliged to operate within the diplomatic guidelines for Arctic Observers expanded by the Arctic Council in 2023. This compliance has been managed primarily by Russia and Canada, who are China’s two primary partners in the region.

China has continued to access Russian energy resources and is increasingly shipping cargo via the northwest and northeast sea routes. These are open to semi-autonomous cargo ships taking pre-set routes from March until November. Russia and Canada primarily manage these routes, paying a portion of commercial fees to Norway, Greenland, and the U.S. to maintain continuity of safety and stewardship when these ships venture closer to their respective maritime domains. Among other benefits, these funds have fueled Alaska’s economy. Japan and South Korea have also started taking advantage of this autonomous ship route to bring goods to market. Morocco becomes the first African country to join the Arctic Council as an observer. Its auto industry is booming through investments by European and Asian car makers, and Morocco has started to employ semi-autonomous ships to deliver its cars via the Northern Sea Route to Asian markets.

Even as the boom in hydrocarbons continues, the market for green technologies has started to expand as the U.S. grows more urban, engineering solutions improve, and the U.S. public has demanded more resilience for the energy grid. More installations are built to capture wave and wind energy in coastal areas, including within the Great Lakes. Locations near existing shore infrastructure are popular due to access to services and land availability. Some small-to-medium sized ports have downsized or have begun renting space out as shipping
operations become more efficient. As more dual-purpose transportation and energy sites are considered, decision-makers struggle with how to integrate these different types of infrastructure where usages conflict, particularly when rising sea levels complicate the situation.

The U.S. space sector has flourished. Global interest space for communications, navigation, and situational awareness, as well as (potentially) mobility and raw materials has increased throughout the commercial world. Strong multi-lateral diplomacy has led to somewhat less emphasis on military competition and more effort dedicated to safety and stewardship in the space domain. NASA has been asked to work extensively with its interagency partners to help the U.S. move from a space program into “space prosperity.”

The market for recreational drugs, however, has not expanded. Marijuana legalization has been scaled back, as many states move to limit the number of storefronts, locations of dispensaries, and when products can be purchased, and there has been a cultural shift: consuming marijuana now garners the type of disdain that smoking cigarettes once did. The U.S. government is making a dent in the opioid crisis that peaked in number of deaths and prescriptions in 2019. This required not only working closely with patients, care providers, and legal drug manufacturers, but also stifling illegal trafficking of opioids into the U.S. from primarily from Russia via staging points in Venezuela.

New pipelines for moving hydrocarbons have started to relieve congestion in chokepoints such as the Straits of Malacca and Hormuz. The U.S. increasingly works with partners along heavily used historical shipping areas to maintain freedom of movement. The U.S. is increasing its presence – focusing on safety and sea lane stewardship – around the South China Sea (though the U.S. has avoided the Taiwan Strait), Gulf of Aden, Gulf of Oman, Persian Gulf, and around Brazil’s largest ports of Itajui and Tubarao. In 2022, Brazil began accusing Venezuela and its partner Russia of sending shadow forces to disrupt its maritime operations after it refused to recognize the Russian-backed leadership. The U.S. has agreed to assist Brazil with patrols, especially in light of evidence that Russia and Venezuela seek to open up the market for recreational use of opioids in Brazil.

Increased U.S. maritime presence in Southeast Asia and the Middle East countries has been tolerated somewhat more than theorists predicted in the early
2020s due US contributions to protecting fisheries and limiting the transport of illegal catch, including through trans-shipment. After a series of studies predicted catastrophic effects of over-fishing and climate change on fisheries by 2035, many fish producing and consuming countries around the world agreed to find new ways to work together to preserve this valuable food source for the now 10 billion people predicted to inhabit the planet by 2050.

Smart contracts fueled by blockchain technology have helped manage growing demand for moving materials and goods around the world by increasing the efficiency of the shipping industry. Many organizations within maritime industries are moving towards more distributed decisions and operations for digital security and to be more responsive to local conditions and needs. U.S. flagged vessels have been required to install navigation system upgrades to support electronic aids to navigation, which will be the global standard by 2032. However, the “digitization” of the maritime industry has spurred increases in cyber piracy in the maritime domain. Hackers seeking ransom money disrupt ships’ navigation systems and electronic tools and/or deny networks and systems used at ports until payments in digital currency are received. Cryptocurrency has become very popular for international trade, but its vulnerability to hackers has caused a handful of risk-averse major U.S. companies to require precious metals be used for international trade, and heavily armed vessels carrying the metals have begun to traverse the oceans. It is suspected that the full value of the precious metals is not being properly reported or taxed.

In 2026, China may have begun testing a cyber weapon using a “back door” vulnerability built into digital navigation infrastructure that jams virtual buoys so that all operators can see on their screens is noise. Decentralization of the Tech Industry has enabled more multi-national partnerships and cooperation that has led to technology advances and proliferation; it has also made it harder to detect nefarious activities by state and non-state actors alike.

A series of scandals in 2026 revealed that some U.S. women have sold frozen human eggs to Asian countries where demand for them is on the rise. Ships became the most common way to transport these frozen eggs, where they were easy to hide within containers of legal cargo. This demand for healthy human eggs was driven by an outbreak of a virus causing mass sterilization and birth defects among some Asian populations. U.S. ports of entry continue to be on high alert for
passengers that may be suffering from this virus. The handful of cases that occurred within the U.S. (all resulting from people who had recently arrived from overseas, plus their immediate contacts and medical professionals treating them) have been contained. Assiduous efforts are made to interdict all U.S.-bound travelers from Asia who appear to be infected with the virus. However, it has now spread to a substantial population in Panama, and there have been a number of cases in Costa Rica and Colombia. Due to both fear of the virus and its impact on local economies (particularly tourism), growing numbers of migrants from Costa Rica, Panama, and Colombia are seeking to enter the U.S. via Mexico. The Coast Guard has already detained a handful of boats carrying migrants from these nations near U.S. shores, and personnel performing this mission are increasingly concerned about exposure to the virus via pre-symptomatic carriers.

The U.S. is experiencing historically low immigration which is tightly managed by interagency partners, and even fewer U.S. births. Economic prosperity and growing social acceptability of remote work has helped families move geographically closer together and has contributed to a decline in the number of divorces. Prospects for a “gig” economy have declined, with temporary work viewed as risky and associated with low income status. While this has created some incentives for young people to join military services, both young people and their parents are highly concerned about the risks service careers may pose in terms of sustaining physical injuries or fatalities.

In 2024, the U.S. overhauled healthcare to create a single-payer system. All U.S. residents now have similar access to healthcare, with very limited out-of-pocket expenses, though there is still some unevenness in quality of care. Urban areas still have more advanced medical options with lower wait times. There has been a small decline in student interest in medical and biomedical engineering degrees, though jobs in healthcare and pharmaceuticals are still viewed as lucrative and largely stable. A big issue under debate with the 2032 elections ahead is whether to encourage immigration specifically for medical professionals and caregivers in order to address the growing needs of an aging population. Historically low unemployment rates have also contributed to popular support for immigration.

Here are some of today’s news headlines:
• Undersea Arctic oil and gas fields are producing at capacity; oil pipelines open in southeast Asia
• Northern Sea Route tariffs fund Alaskan universities
• Birth rates in Asia still dropping
• Fish fraud on the rise as farmed seafood swapped out for “luxury” wild caught filets
• Space is open for business: Will NASA need partners in the U.S. interagency to manage it?
• Temporary work is on the decline among Americans – only 10% now seek employment within the “gig” economy
• Explore the latest green electricity in your neighborhood
• Rhode Island and Connecticut re-criminalize recreational marijuana

LEGEND OF COMMON MAP SYMBOLS

- Coast Guard or Naval Patrol
- Extreme Flooding
- Oil and Gas Production
- Violent Confrontation/Explosion
- Shipping and Vessel Movements
- Protest, Riot, or Civil Disobedience
- Hurricane/Typhoon
- Illegal Drug Controls
- Economic Growth
- Hazard or Infrastructure Closure

- Health or Humanitarian Crisis
- Fire
- Near-Peer Influence
- Accident or Collision
- Fishery Impact
- Autonomous Innovation
- Cyber Event or Breakthrough
- Communications Systems
- Ice or Snow Impact
- Refugee or Migratory Crisis

COLOR CODING

- Water
- Economic Crisis
- Hazard
- Other

NETWORKS

- US and Allies
- Adversary
- Borders
The Arctic has been fully opened to oil and gas exploration. Autonomous ships and mineral resource revenues contributes to booming northern tier economies. The US space industry is thriving. The US maintains an active security presence in the Middle East, providing fishery protections. In contrast, the geopolitics of South America is more complicated with Russian support of Venezuelan interference in Brazil.
Future Scenarios

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Scenario 3: Diverging Paths

Images (clockwise from top right) via:
Minko Chernev/Fotolia, serge_t/Fotolia, v_l/Fotalia, Casey E Martin/Fotalia.

These scenarios were generated by HSOAC-RAND in support of the U.S. Coast Guard’s Project Evergreen V. This is not a forecast, but one of many plausible potential futures. It was developed by combining major drivers of change, and imagining their potential interactions and outcomes. Last updated August 2019.
3: Diverging Paths

Today is September 10th, 2030. A lot has changed in the last decade:

The northern jet stream has increasingly started to meander and experience stalled Rossby waves, which are bends in this “air river” that get stuck in place for days at a time. This has led to unusual geographic patterns in low- and high-pressure systems that cause high-intensity storms in the U.S. Midwest and southeast, extreme drought in the southwestern U.S., and extreme summer heat waves throughout North America and Europe.

Intense rainstorms have battered the upper Midwest from March through November for the last three years, resulting in extreme flooding in the Great Lakes as well as in the Des Moines, Mississippi, Missouri, Ohio, and Platte Rivers. At the same time, the Great Plains states and the southeastern U.S. have experienced repeated wintertime Derecho storms, resulting in hurricane-force winds, thunderstorms, and flooding in areas around the Arkansas, Missouri, and Rio Grande Rivers, and around the ports of Baltimore, Norfolk, Savannah, and Tampa. Unusual weather patterns have led to the opposite effect in the southwestern U.S., where water levels in the Colorado, Gila, Sacramento, San Joaquin, and Klamath Rivers are at record lows.

Decreasing interest rates in the early 2020s led to growth in several sectors, including agriculture and manufacturing (especially machinery and vehicle parts). Storms have damaged large areas of corn and soybean crop land, factories and supply lines for raw materials, as well as infrastructure needed to transport goods, including via inland waterways. The southwestern U.S. has dealt with a different set of problems, including disrupting river barge traffic, related to frequent droughts.

There had been growth in communities for older Americans at urban riverfront properties and along the coasts, especially during the early 2020s. At this time, housing prices started to decline due to the limited and expensive options for insurance in areas newly designated flood zones by insurance companies. The growing geographic dispersion of families has decreased availability of family-
based care for the elderly and increased the market for professional caregivers and pressure on hospitals to provide comprehensive care for the elderly. The large number of older Americans caught in U.S. Midwest and Southeast storm areas complicates relief efforts. More recent river and coastal flooding from storms have further shifted desirable housing markets in these regions.

Response and recovery efforts have begun suffering from a number of additional challenges. Crime in recently storm-battered communities has skyrocketed. There have been large-scale break-ins at seemingly secure port facilities, causing a spate of Hollywood movies on the subject. Applications designed to digitally manage storm response and recovery are not secure and massively fail due to cyber-attacks that appear intended to confuse U.S. authorities while foreign agents smuggle drugs and humans into the U.S. through disrupted ports.

Other than extreme droughts, the West Coast of the U.S. has been relatively shielded from the chaos breaking out elsewhere in the country. Jobs in advanced technology have become more common and it has become difficult to find manual labor. The region has prospered through its continued development of applications for automating basic human tasks. There has been some decline in population in California, Oregon, Nevada, and Arizona. This is attributed in part to the drop in jobs requiring intensive manual labor and fears about water stress.

The Ports of Los Angeles/Long Beach, Portland, and Seattle are on the road to becoming “minimally manned.” Security, for example, is fully automated using two-factor authentication that leverages biometrics and implanted microchips that have replaced the Transportation Worker Identity Credential (TWIC). Analysts at centralized facilities can monitor both maritime and road traffic to and from the port and leverage new electronic bills of lading.

A conglomerate of companies in California that comprise 92% of the Californian economy has struck deals with Chinese state-owned enterprises to gain access to more rare earth elements to further develop computing and communications technologies. In an unprecedented move, the state of California has been acting as a proxy for the California conglomerate. This diplomatic and economic deal is struck following a more limited U.S. presence in southeast Asia and promises to share some technologies with China. For its part, China is changing international norms in a direction that serves its interests, especially in
the Arctic. This convinces it to multiply diplomatic channels and efforts to “fit in” with international organizations such as the IMO and consider changing them from the inside. China is also increasing its economic investments with Arctic nations, in order to gain a diplomatic and economic advantage in the Arctic.

The U.S. has also become increasingly interested in rare earth reserves in Greenland, but a sudden decrease in the pace of Arctic warming has left these resources more difficult to extract than anticipated. The multiple geoengineering efforts that began in 2026-2027 have likely contributed to this, though ocean acidification has not been affected. Furthermore, Arctic sea ice remains stagnant in northwestern Greenland and parts of the Canadian archipelago, rendering the Northwest Passage unusable for large-scale shipping operations. There has been a steady increase in Northern Sea Route transits, and the central Arctic route remains essentially un navigable except by ice-hardened vessels.

Bolstered by a newly signed international mandate to combat any future climate change, a powerful international counter-climate change interest group has massively invested in geoengineering new sea ice, to complement earlier geoengineering efforts. This serves to improve the reflection of solar radiation back into space but proves to be a hazard for the relatively few ships transiting Arctic waters.

Russia has taken issue with this and other forms of geoengineering, but has been tempered in its response because of the limited effect on Northern Sea Route traffic (already low). Economic difficulties within Russia and a series of popular protests against cost of living, increased taxation, and “revised” health benefits result in a freeze of defense expenditures, as the Russian leadership tries to maintain peace at home and fears for its hold on power. China is frustrated by Russia’s sudden turn inwards and looks to expand its options for international partners.

Some fisheries have migrated northward. However, slower-than-expected sea ice melt means that fish cannot be extracted from northern waters at rates that meet rising global and U.S. demand for sea-based protein.

Despite the aging American population, the national debt has come down due to increased productivity throughout the labor market, creating rapid growth in Gross Domestic Product (and tax revenues). Increasing levels of use of marijuana
and other recreational drugs have made military service less attractive, since potential recruits are resistant to having to give up the use of those drugs. Digital infrastructure is centralized in urban areas, which increases the draw of people to cities, especially at the coasts. This puts pressure on housing and services in urban areas.

Improved health-care coverage has rapidly increased the rate of self-employment, since individuals are no longer seeking employer coverage. Moreover, the provision of a low basic income for all—$1,000 per month for every person—has given people more confidence and flexibility. Many people of all ages, but particularly those under 40, are excited at the prospect of doing work on their own terms: they like the freedom of working for the clients whom they prefer, and to do so largely when they want. The result has been a blossoming of the “gig economy,” as people seek independence over the stability of a consistent job, let alone an enduring career.

The average age at marriage is now 34, while the average age of first-time parents is 37. Divorce rates have fallen to levels not seen since the 1960s, in part because a strong social-safety net has reduced economic stresses within families. Much higher rates of contraceptive use among young people have dramatically reduced rates of out-of-wedlock births. Extended families are increasingly choosing to live in close geographic proximity to each other, particularly since a large percentage of jobs can be done from any location, so they have more freedom to live where they want.

Here are some of today’s news headlines:

- Midwest and Mid-Atlantic prepare for Derecho storms and rainstorms
- California signs a new deal with China for rare earths
- Machines alleviate manpower needs at ports
- Homelessness in older Americans rises following disasters
- Early detection leads to lowest cancer mortality rates in history
- Geoengineering diminishes the rate of climate change
- According to the Bureau of Labor, 53% of Americans are now self-employed in the flourishing “gig” economy
- The nuclear family flourishes as divorce rates drop
Global Map of Scenario 3. An economic crisis in Russia has sparked protests and civil disobedience across its vast domain. The US and Canada collaborate on geoengineering sea ice to decrease the albedo of the Arctic Ocean and keep the access to the Northwest Passage and its resources locked. Rare earth metals and materials are of critical importance to the global economy. The eastern United States is inundated with several major floods and a derecho thunderstorm unleashes hurricane-like damage across the Midwest and Mid-Atlantic.
Regional Map of Scenario 3. The United States is riven with substantial economic and environmental differences across the continent. East of the Mississippi, end of winter and early spring floods have devastated Omaha, NE; Kansas City, MO; St Louis, MO; Tulsa, OK; Little Rock, AK; and several Texas cities. The Southwest cannot shake an extreme drought and persistent heat waves in the Northeast and Great Lakes region cause a major crisis for an aging population. The ports of Baltimore, MD; Norfolk, VA; Savannah, GA; and Tampa, FL experience extreme flooding. In contrast, Seattle, WA; Oakland, CA; and Long Beach, CA are largely efficient and autonomous. California makes a deal with China to secure its economic future, unable to rely fully on Washington. Fisheries are migrating further north and offshore out of some of the US EEZ.
Future Scenarios

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Scenario 4: Increasing Disorder

Images (clockwise from top right) via:
Matt Gibson/Fotalia, kuchina/Fotalia, jamesteohart/Fotalia, Chris White/Fotalia

38 These scenarios were generated by HSOAC-RAND in support of the U.S. Coast Guard’s Project Evergreen V. This is not a forecast, but one of many plausible potential futures. It was developed by combining major drivers of change, and imagining their potential interactions and outcomes. Last updated August 2019.
4: Increasing Disorder

Today is September 10th, 2030. A lot has changed in the last decade:

Ships have begun to move freely through much of the Eurasian Arctic from March until late November. Much of the surface vessel traffic consists of small semi- or fully-autonomous cargo vessels. Autonomous shipping began as a joint venture by China and Russia. The Arctic has become the only place in the world where autonomous vessels regularly operate due to safety concerns raised through the International Maritime Organization (IMO) and by maritime insurers. There has been a moderate increase in the presence of (non-autonomous) fishing vessels, tourist ships, and pleasure craft. Tanker traffic rose from a small baseline in the early 2020s but is experiencing limited growth due to a shaky decline over the past several years in global consumption of hydrocarbons.

Part of this decline has resulted from collaborative engineering research by Japan and India in developing large, long-lasting batteries, such as those that can be utilized to power vehicles and vessels. Isuzu and Tata were among the first to take advantage of these technologies in 2025, which has drastically reshaped offerings for fully electric vehicles. These companies have helped proliferate these cars in southeast Asia, where they continue to be in high demand due to intensifying adverse effects of air pollution on human health and well being.

Tsuneishi Shipbuilding and Malaysia Marine and Heavy Engineering have been partnering with Port-Liner and Rauma Marine Constructions to build a large variety of all electric ship types. These include cruise ships, car ferries, cargo ships, fishing boats, and patrol boats. Electric ship technology is slowly being adopted worldwide, particularly in Asia and Europe. In 2028, the U.S. government began an analysis of alternatives for replacing many of its smaller military vessels with e-ships.

Small “drone” boats – primarily used by criminal organizations to transport illegal goods and by law enforcement to surveil ports – have been proliferating at an intensifying rate since the early 2020s. Russia pioneers the large-scale use of autonomous surveillance vessels in the Bering Strait to monitor vessel traffic and environmental conditions, including early warning of fuel spills and whale movements into shipping lanes.
This has been part of Russia’s broader effort to establish its position as the strongman in the Arctic and extend its “near abroad” to America’s doorstep. Russia has fully operationalized its dual-purpose military and civilian infrastructure along the Northern Sea Route and charges tariffs for shipping through the region. Despite a depressed hydrocarbon market, Russian oil and gas has seen a relative boom due to increasing chaos in oil-producing Middle Eastern and African States. The Strait of Hormuz remains blocked by Iran following a series of intensifying military skirmishes in 2027. Russia becomes increasingly assertive with its Arctic neighbors, threatening to pull out of the Barents Euro-Arctic Council and unilaterally denouncing the 2011 treaty delimiting its border with Norway in the Barents Sea. Pro-Russian media sources, and occasionally the Russian government, periodically claim that the U.S. violated the 1867 agreement by which it purchased Alaska, demanding that Russia be compensated. A series of incidents on and near Svalbard involving “fishermen” who might be in fact Russian military makes Norway increasingly nervous. Norway reaches out to its NATO allies to obtain a formal commitment on their part that they would consider an attack on Svalbard to be an attack on Norway, which would trigger the collective defense clause of the Atlantic Treaty.

By 2023, the U.S. military presence in the Middle East has been confined to a few, longstanding bases in Bahrain, Kuwait, Qatar, and the United Arab Emirates. Iran has made it clear to those countries that if their territory is used to support attacks against Iran, those countries will be targeted with nuclear weapons. North Korea is making similar threats against South Korea and Japan.

The U.S. focuses more internally as hurricanes and other storms repeatedly batter coastlines, especially in the Gulf of Mexico, southeast, Caribbean, Hawaii, and Alaska. However, in 2026, the U.S. realized that disengaging from global affairs leaves a void for others to fill. China has continued to fund infrastructure projects in North and South America and is now offering lucrative trade deals in exchange for gaining a military foothold. China sought connections with Mexico in particular. The trade treaty that the two countries concluded has increased their exchanges, in value, by 300 percent. China-built infrastructure has earned Mexico City the nickname of “Shanghai of the Americas,” and Mexico becomes a leader in the region in various industries, including the production of electric cars. Russia remained allied with Venezuela and Cuba and begins offering security assistance to help quell increasing social unrest and government crackdowns in Argentina and Colombia. The U.S. became increasingly anxious when Russia stepped in to...
help manage Panama Canal operations after the Panamanian government falls into chaos.

Sea ice has declined in the southern hemisphere also. China has been eyeing economic opportunities in and around Antarctica. As part of its expanding economic sphere of influence, China negotiated with Argentina and New Zealand to fund additional maritime and communications projects that will support a future increase in its Antarctic operations. In 2027, Great Britain acknowledged Argentina’s sovereignty over the Falkland Islands as part of an overarching plan to reduce its global commitments following Scottish independence and renewed fighting in Northern Ireland. China convinced Argentina to allow the establishment of a Chinese science and icebreaking base at Porto Galtieri in Las Malvinas (formerly Port Stephens in West Falkland).

Four denial-of-service hacks of U.S. public communications systems occur after the U.S. makes moves to re-engage in Central and South America in 2027. This erodes the U.S. public's trust in the government to protect critical infrastructure and leads to calls for massive reforms in cyber policing.

A shadowy domestic terrorist group, the “Mayflower Compact,” has claimed responsibility for a series of mass shootings targeting Native American communities.

The refocusing of U.S. military budgets has made additional funds available to support maritime infrastructure upgrades and disaster recovery. Rising sea levels and intensifying storms throughout the year have resulted in massive needs for both military and civilian infrastructure spending. A series of intense tornadoes ripped through the Great Lakes in 2026, destroying a large amount of shore infrastructure there, in addition to harming people, homes, and businesses. Weather patterns on the Great Lakes have generally become more volatile, leading to increasingly uncertain safety conditions for boaters, fishermen, and barge traffic. Port complexes and coastal military installations in Louisiana, Houston, Virginia, and Seattle (among others) frequently find themselves underwater during seasonal storm surges, and often face moderate flooding even in the absence of storms, limiting access to the ports and assets.

At the same time, worsening drought conditions have contributed to declining populations in parts of the western United States. Water rationing has become
particularly severe in California, and the collapse of the state’s agricultural economy has caused a mass exodus.

Cryptocurrencies have become much more accepted in societies around the world, not least because they support populations with limited access to physical banks, which are now on the decline everywhere. Cryptocurrencies have also fueled the “gig” economy in the U.S. and elsewhere. More Americans have embraced temporary employment than ever before. Temporary employment is most common in Americans under 25 and those seeking partial retirement after age 50.

The dollar is no longer the dominant currency globally; its role was eroded by the relative rise of China (whose yuan is now dominant) and accelerated by a series of successful hacks of U.S. banks that led to counterfeit digital dollars proliferating. China is able to effectively leverage its majority ownership of U.S. debt, which has grown to 116% of Gross Domestic Product, in great-power competition. With encouragement by Russia, China suggested in 2027 that it will start to sell off treasuries if the U.S. attempts to interfere with its activities with Russia in the Arctic and South America. World markets continued to be shaky following this news, and the U.S. economy stagnated further.

Cryptocurrencies and other blockchain-enabled technologies have caused industries to save money by moving more into the digital domain. Operations and organizations themselves becoming increasingly decentralized. The need for middle-men in negotiating contracts and payments has become non-existent or minimal. Maritime businesses have not missed the “digital wave” and become increasingly digitized, autonomous, and decentralized.

The U.S. public has embraced the digital environment, adding themselves to the “Internet of Bodies” via microchips and other technologies at an increasing rate. Much of the U.S. population, which is growing younger, supports giving up some privacy for the benefits of being integrated into an increasingly connected, digital world.

Animal-rights activists have contributed to a cultural change regarding perception and treatment of animals. At the same time, plant-based substitutes for fish and meat have become inexpensive and highly palatable. As a result, U.S. consumption of both fish and meat has plummeted.
An increasing ability to monitor human productivity at scale has produced convincing results that work periods should not exceed four hours. The U.S. has followed New Zealand, Japan, and Sweden in transitioning to a “split shift” economy in which workers take substantial breaks between two four-hour work periods per day. Many organizations have begun to favor a system for splitting shifts that also enables 24-hour operations where remote work – increasingly accepted in society – is the norm. Most employees work on one of the following schedules (denoting working hours): A. 0000-0400/1200-1600; B. 0400-0800/1600-2000; C. 0800-1200/2000-2400. Expanding digital infrastructure and acceptability of remote work starts to limit desires of people to live in urban areas. For the first time in years, rural areas have started growing (slowly) again, and many people have begun to prefer suburban neighborhoods.

The younger public in the U.S. has become very excited about autonomy, including using autonomous boats for recreation. Autonomous boating in the U.S. becomes popular for international visitors as well as domestically. Ocean-facing as well as inland water harbors and marinas are in the process of expanding and upgrading to handle the volume of demand and rapidly evolving technology. Areas like the Salton Sea in California, Rend Lake in Illinois, and Onondaga Lake in New York that were previously allowed to decay are being refurbished as new water resort areas. Incidents involving passenger injuries, wildlife collisions, and fuel spills suggest that regulations are unevenly followed in this emerging industry.

Autonomous ride-sharing now strongly competes with historic public transportation systems. With fewer concerns about effects from driving under the influence, largely legal marijuana and synthetic drug use is on the rise. Young people are increasingly reluctant to join any of the military services, because those services continue to ban the use of marijuana and other drugs.

Embracing the digital environment has also led to an erosion of social connections between people. Cohabitation – rather than marriage – and single-parent households are on the rise. This, combined with a greater tolerance for risky behavior and the devastating effects of storms on housing and employment, has led to greater incidence of poverty, especially among families with small children.

A drug-resistant form of HIV has appeared and is spreading rapidly as riskier sexual behaviors have become more common. It has not yet been determined
whether the new form of the virus was the result of accidental mutations or deliberate creation in a laboratory. Military services are struggling over the question of how to reach recruitment goals despite a large percentage of the teenage population testing positive for the new form of HIV.

Here are some of today’s news headlines:

- Russia updates its military doctrine with a definition of “near abroad” that looks east towards Alaska
- The last U.S. military troops leave Jordan
- Malaysia unveils a faster, more fuel-efficient e-Ship
- Remote, split-shift work catches fire
- The Great Lakes region prepares for more tornadoes
- Temporary work is replacing retirement
- Explosive-laden vehicles have been used to attack government buildings in Spain, Portugal, and southern France; the Al-Andalus Liberation Front claims responsibility
- China releases the latest synthetic drug to the U.S. market
Global Map of Scenario 4. The Russians have firm control over the Northern Sea Route with a declining US armed presence in the Middle East. Numerous economic and environmental innovations are occurring in Asia and the Indian Subcontinent. There are numerous natural hazard disruptions in the continental US, including coastal flooding and tornados. The Chinese sphere of influence has expanded to Mexico and Antarctic region.
Appendix B. An Expert Workshop to Identify Important Drivers for the Coast Guard

In continuing the Evergreen tradition of engagement and education, our team of HSOAC experts facilitated a day-long workshop at Coast Guard headquarters in Washington, D.C., on October 22, 2018. This workshop is an example of how the Coast Guard might collect inputs for the stressors-and-shocks framework presented in Chapter 3. This workshop was important for testing whether developing stressors and shocks of different types is useful for Coast Guard planning (it is) and how the impacts of these two types of change are similar or different for the Coast Guard’s operating environment and missions. This appendix outlines the workshop approach and the mechanics of two “serious games” we developed for the workshop.  

We also summarize the workshop results, including linking drivers of change to mission-based impacts and decisionmaking impacts, discussing interactions between the statutory missions and certain drivers of change, and considering implications of the workshop findings for scenario development, discussed in the main body of this report.

Workshop Approach

The workshop employed two “serious games” (Mendler de Suarez et al., 2012) that we developed as a means of generating insights about potential drivers of change. The key areas of investigation were to identify major categories of drivers that might be missing and why certain stressors or shocks were important for the Coast Guard’s operating environment, along with the types of decisions the Coast Guard might face in response. These games were useful in engaging workshop participants and helping participants move away from their own near-term perspectives on issues related to current jobs, recent experiences, and so on. We used the two games to elicit two types of information, as described below.

The first, called the Driver Advocacy game, engaged workshop participants in advocating for why their assigned category of drivers was particularly important for the Coast Guard.  

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39 Both games were developed by the project team, but the Future Shock game was inspired by the Decisions for the Decade game developed by Pablo Suarez and Janot Mendler de Suarez for the Red Cross Red Crescent Climate Centre, simplified from a game developed for the World Bank’s chief economist for sustainable development.

40 To build this list, we drew from Coast Guard strategy and MARs, prior Evergreen scenarios, DoD and other government planning documents, documents from private strategic foresight and long-range planning organizations, and subject-matter discussions with Coast Guard personnel and personnel internal to HSOAC.

41 We structured the workshop content using a modified political, military, economic, social, information, infrastructure, physical environment, and time planning framework that the U.S. Army developed to describe the operational environment. We modified the framework to focus on the following driver categories: physical
activity helped us evaluate whether it makes sense to separate drivers into categories for purposes of populating the stressors-and-shocks framework discussed in Van Abel, Wilson, and Anania, unpublished, as well as highlight example Coast Guard missions with high-level impacts.

The second game, the Future Shock game, had groups of stakeholders assume the roles of decisionmakers and adjudicators and then make decisions about how to allocate “resources” across the statutory missions in order to prepare for the future and respond to specific shocks. The decisionmakers had imperfect information about which shocks occur in the future, and the adjudicators had perfect information. This activity helped identify which shocks presented in the game might cause strain on the Coast Guard, illuminate any potential need to create new missions or rebalance resources across missions, and the types of decisions the Coast Guard might need to make in response. In the rest of this appendix, we describe the mechanics of the games in more detail.

The Driver Advocacy Game

The Driver Advocacy game is a competitive team game in which the objective is to develop an argument that a category of drivers is particularly important to the Coast Guard. The steps of the game are outlined below.

1. **Have a briefing and trial round.** To familiarize participants with the structure of the game, we conducted a trial round with the full group, using the physical environment driver category as the example.

2. **Break into teams.** After the trial round, the group split into ten teams, with two teams assigned to each of the five remaining driver categories: geopolitics and international security, economic, social, policy and regulatory, and technology.

3. **Build an argument.** Upon breaking participants into assigned groups, we provided each participant a one-page briefing sheet on their driver category that included an illustrated trend, as well as several current news headlines illustrating either recent shocks or ongoing challenges. The team’s argument was captured on a facilitation worksheet (see Figure B.1) that asked the group to do the following:
   - Give its opinion on the certainty of the driver (low or high).
   - Select which mission or missions the driver might directly affect.
   - List some example impacts.
   - Identify what types of decisions the driver will influence (e.g., policy, personnel, materiel, acquisitions, basing, organization).

4. **Present an argument before the other teams and take an instant poll.** A team rapporteur shared the results with the room, and an instant poll was taken for each room environment, technological, economic, geopolitics and international security, policy and regulatory, and social. Previous HSOAC work for DCO-X used the same categories (see Tingstad et al., 2018).
on who was most convincing. The poll was meant to provide an incentive for each team to really engage in advocating for its assigned category of drivers.

For outputs, we collected from each participant any anonymous note-taking forms, as well as the group’s facilitator notes and completed worksheet.

Figure B.1. Driver Advocacy Game Facilitation Worksheet

Driver Category: ____________________________

<table>
<thead>
<tr>
<th>Driver</th>
<th>Certainty?</th>
<th>What mission(s) will be directly impacted?</th>
<th>Examples of Impacts?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example: sea ice recession</td>
<td>High</td>
<td>X X X X X</td>
<td>Re prioritization of materiel and staffing personnel in the Arctic</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Opening of new Arctic shipping routes; increased amount of free floating ice</td>
</tr>
</tbody>
</table>

Driver Advocacy Game Results

As noted earlier, the presentation of this analysis is meant to illustrate a use case for applying the steps in the stressors-and-shocks framework presented in Chapter 3. The Driver Advocacy game helped us identify drivers that might have been missing from the list we compiled and specify the relationships between drivers and changes, as well as highlight high-level impacts on Coast Guard missions. We ended up with more physical environment drivers than items in the other driver categories because we used this category of drivers as the example in the plenary session and were therefore able to collect individual responses from each of the workshop participants.

We consolidated similar drivers into 11 stressors and seven shocks and tabulated the number of total mission mentions for each driver. Table B.1 summarizes these results. Across the top on the right, we list the Coast Guard’s 11 statutory missions. Down the left side, we list the stressors
and shocks. For each stress or shock, the mission cells’ colors indicate the relative number of total mission mentions.42

Table B.1. Relationship Between Coast Guard Missions and the Consolidated Stressors and Shocks as Identified by Workshop Participants

<table>
<thead>
<tr>
<th>Mission Abbreviations</th>
<th>Statutory Coast Guard Missions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAR - Search &amp; Rescue</td>
<td></td>
</tr>
<tr>
<td>MS - Marine Safety</td>
<td></td>
</tr>
<tr>
<td>DI - Drug Interdiction</td>
<td></td>
</tr>
<tr>
<td>MI - Migrant Interdiction</td>
<td></td>
</tr>
<tr>
<td>PWCS - Port, Waterway, &amp; Coastal Security</td>
<td></td>
</tr>
<tr>
<td>DR - Defense Readiness</td>
<td></td>
</tr>
<tr>
<td>ATON - Aids to Navigation &amp; Waterway Management</td>
<td></td>
</tr>
<tr>
<td>MEP - Marine Environment Protection</td>
<td></td>
</tr>
<tr>
<td>IO - Ice Operations</td>
<td></td>
</tr>
<tr>
<td>LMR - Living Marine Resources</td>
<td></td>
</tr>
<tr>
<td>OLE - Other Law Enforcement</td>
<td></td>
</tr>
</tbody>
</table>

Legend:
- No Impact
- Minimal Impact (1-2 Mentions)
- Weak Impact (3-5 Mentions)
- Strong Impact (6-8 Mentions)
- Critical Impact (9+ Mentions)

As mentioned above, the physical environment category received more attention than the other categories because it was used as an example for the whole group. As shown in Table B.1, sea level rise appeared to be the primary driver of concern, with participants noting that flooding from storm surge, erosion, coastal redefinition, severed transportation links, changing bridge and port capabilities, and the like could have a significant impact on Coast Guard operations.

Workshop participants did not identify any major drivers that were not already included in the construction of the initial framework. However, they did help link driver impacts to Coast Guard operations, as well as illuminate what types of decisions might be required in response (e.g., new infrastructure, changes to retirement policy). Understanding these decisions is key for developing effective, decision-relevant global planning scenarios. Of importance is that

42 This allows for combining crosscutting analysis categories (e.g., if a driver were mentioned in more than one driver category) and accounts for the number of independent driver mentions (e.g., AVs and drones at both technology tables). Note that this relative ranking reflects only the workshop discussion and does not represent a full analysis of drivers’ relative importance to the Coast Guard.
participants helped us see, from a Coast Guard perspective, how the interactions of drivers could have significant impact on the demand for a Coast Guard mission. For example, although the Coast Guard will likely continue to perform the DI mission in 2040, participants suggested that its relative importance could diminish based on a couple of factors. First, the rise of synthetic, chemically based drugs and misused prescription medications could reduce maritime interdiction of drug flows: Drugs that are made domestically or just across U.S. borders will travel less by sea than, say, cocaine emanating from South America. Second, a more tolerant legal regime with respect to drugs and increased social normalization, particularly of marijuana, could reduce the political focus on DI.

Furthermore, the Driver Advocacy game results helped us reorganize drivers and impacts within the framework for the purposes of developing Evergreen global planning scenarios in a way that more directly related drivers to the Coast Guard’s operating environment. For example, the workshop highlighted environmental impacts on coastal regions and general U.S. population movements toward the coasts, then helped to connect these trends with Coast Guard infrastructure, SAR, and disaster response. The workshop also helped us make important distinctions between global trends and specific regional impacts of importance to the Coast Guard, such as those related to Arctic sea-ice reduction and accompanying implications for Coast Guard SAR, as well as aiding navigation.

The Future Shock Game

The Future Shock game is a noncompetitive, discussion-based game designed to elicit insights based on Coast Guard responses to a set of diverse future mini-scenarios. The purpose of the game is to generate candidate elements for scenario design by gathering information on mission boundaries, scenario consequences, and potential strategic decision options, including the development of new Coast Guard missions. Responses also reveal areas of agreement and difference between participants that can inform the basis for further inquiry.

Game players allocate a limited set of resources (represented by 100 points) across Coast Guard statutory missions in order to prepare for the future or respond to specific shocks. Participants are directed to consider point allocations as the percentage distribution in mission-hours in the future. To allow innovative thinking, the game lets participants identify new statutory missions as well. For a baseline, we provided participants in this game a distribution of asset-hours across the statutory missions from which to begin modifying allocations. The overall structure of the game is as follows:

1. **Have a briefing and review of game materials.** To ensure that players understood the game design and scenario elements, we gave each participant a plenary presentation of the materials an hour before the game and disseminated game materials, including a one-

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43 The baseline asset-hours distribution was based on actual hours from FY 2018.
page description of each of the potential shocks and a narrative on the future world within which the shocks take place. Participants could read these materials during the lunch hour. We responded to questions on rules and content before and during the game.

2. **Break into teams.** To play the game, participants split into ten teams and played two rounds. We gave each team a team worksheet to record its allocation (see Figure B.2). Within the five sets of paired teams, each team alternated between one of two roles in each round of the game: decisionmaker and adjudicator. Decisionmakers made allocations under uncertainty, knowing only the overall environment and the potential shocks that could arise but not knowing which shocks occurred. Adjudicators set their allocations knowing the shocks that occurred. For purposes of the game, the omnipotent adjudicator’s allocations are assumed to be the optimal allocation and were used to compare preparations for known shocks with preparation for unknown shocks (i.e., decisionmaker allocations).  

3. **Allocate points.** Each decisionmaker team was paired with an adjudicator team. The adjudicator team randomly determined the shocks applied to the scenarios; the adjudicator team was informed of the shocks, while the decisionmaker team was not. Both teams set their resource allocations out of 100 points, and then the decisionmaker team was informed of the shocks.

4. **Have decisionmakers reallocate.** After the shocks were revealed, decisionmakers could reallocate a small number of points (up to ten), which were meant to represent short-term, surge response actions.

5. **Reflect on the game.** We informed each team of its paired team’s allocations and asked each team to provide some short, written responses to two questions (listed below) intended to illuminate real-world analogues of their choices and provide thoughts on what strategic alternatives might be available to the Coast Guard in both the short and long terms.

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44 We assumed that, if presented with the same information, decisionmakers and adjudicators would make the same optimal allocations and that therefore the difference between the allocations in the game would be due only to the uncertainty that decisionmakers face. In reality, there might be different opinions of what the optimal allocation is.
Figure B.2. The Future Shock Game Point Allocation Worksheet

<table>
<thead>
<tr>
<th>Role:</th>
<th>Shocks:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Baseline</th>
<th>Adjudicator</th>
<th>Decisionmaker</th>
<th>Reallocation (10 points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search &amp; Rescue</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marine Safety</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drug Interdiction</td>
<td>35</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Migrant Interdiction</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Port, Waterway &amp; Coastal Security</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Defense Readiness</td>
<td>8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aids to Navigation</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marine Environmental Protection</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ice Operations</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Living Marine Resources</td>
<td>15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Law Enforcement</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (should sum to 100)</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Adjudicator Questions**

1. Compare your allocation with the decisionmakers’ allocation. Where do you think they will have the most problems?
2. Identify up to three real-world investments in capacities or capabilities consistent with your allocation that would have to be made well in advance of this future to ensure Coast Guard success.

**Decisionmaker Questions**

1. Compare your final allocation with the adjudicators’ allocation. What is your most significant shortfall, and what are up to three real-world consequences of that shortfall?
2. What assets, human resources, or policy adjustments would you have to surge or sacrifice in order to execute your change in allocation?

Like in the Driver Advocacy game, facilitators provided collective note-taking on either dry-erase boards or easels and captured team allocations. For outputs, our team of HSOAC researchers collected allocation sheets and written responses from each team.
Future Planning Scenario for the Future Shock Game: The World by 2040, Plus Shocks

To build a future scenario for this game, we extended and exacerbated historical trends to create a stressed future world (but that was otherwise largely business as usual) set in 2040. Against this backdrop, we then injected a set of random shocks built from known concerns within the Coast Guard. In the context of the game, these shocks play out over the course of a decade. The game allows multiple shocks to occur in each round and provides a mechanism for some shocks to be more “extreme” in nature. We vetted the overall structure of this future environment across our team, with the research sponsors, and with outside experts. Table B.2 provides a summary of the future world in our Future Shock game, which we call Booming on the Brink, in which economic growth is strong but under threat from changes in the physical environment. Table B.3 summarizes the shocks we developed for the game.

Table B.2. Future Shock Game: A Short Description of the World in 2040

<table>
<thead>
<tr>
<th>Driver Category</th>
<th>Future State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical environment</td>
<td>Proactive greenhouse gas emission–reduction policies appear to have mitigated the worst climate change trends and consequences predicted in a 2018 report (Intergovernmental Panel on Climate Change, 2018). However, the physical environment still experiences significant change and remains a threat to Coast Guard operations.</td>
</tr>
<tr>
<td>Technology</td>
<td>Advances in artificial intelligence, automation, alternative energy, and resource extraction have continued to propel the U.S. economy forward.</td>
</tr>
<tr>
<td>Economic</td>
<td>Riding a wave of high-tech efficiencies and booming oil and liquefied natural gas energy exports, the U.S. economy is surging but is perhaps overheated.</td>
</tr>
<tr>
<td>Geopolitics and international security</td>
<td>Wealthy nations have been able to adapt to the changing physical environment with technology and expensive engineered protection projects. Disaster aid for industrializing and newly industrialized nations is typically inadequate.</td>
</tr>
<tr>
<td>Policy and regulatory</td>
<td>Domestic agencies struggle with regulatory responsibilities and law enforcement as they strive to enforce laws and regulations in the context of new social and economic conditions.</td>
</tr>
<tr>
<td>Social</td>
<td>The United States continues to attract the world’s best and brightest, there is moderate cooperation on domestic evidence-based policies, and the country stands united against foreign threats.</td>
</tr>
</tbody>
</table>

45 Because this workshop occurred toward the beginning of the research effort, and thus prior to defining the scenario development approach proposed in Chapter 4, the scenario we created for the workshop did not follow the steps outlined in Chapter 4 and is not one of the scenario narratives included in this report.

46 To develop the shocks, we consulted with SMEs in the Coast Guard and our internal HSOAC team.
Table B.3. Our Future Shock Game: A Short Description of the Shocks

<table>
<thead>
<tr>
<th>Potential Shock</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The Big Spoof</td>
<td>GPS in districts 1, 5, 8, and 9 is jammed and spoofed.</td>
</tr>
<tr>
<td>2. What Swims Beneath</td>
<td>Illegal fish transshipment and human smuggling are increasing; all U.S. ports and fishery stocks are affected, with some focus on district 17.</td>
</tr>
<tr>
<td>3. The Blind Side</td>
<td>Radiac alarms on vessels destined for the Ports of San Francisco and Oakland (district 11) and Virginia (district 5) go unresolved; one vessel has gone dark.</td>
</tr>
<tr>
<td>4. Things Fall Apart</td>
<td>Smuggling and other threats increase in districts 8 and 11 because of instability in Mexico.</td>
</tr>
<tr>
<td>5. The End of the World as We Know It</td>
<td>A new avian flu identified in Hong Kong spreads to California (district 11), while an Ebola outbreak threatens western Africa and a new strain of Middle East respiratory syndrome coronavirus is identified in the Middle East.</td>
</tr>
<tr>
<td>6. Oil and Water Don’t Mix</td>
<td>Environmental impacts in the Arctic (district 17) and along the U.S. Gulf Coast (district 8) are increasing international tensions.</td>
</tr>
</tbody>
</table>

NOTE: GPS = global positioning system. Radiac alarms alert to nuclear radiation.

Future Shock Game Results

As described previously, the Future Shock game was intended to illuminate the relationship between different shocks and Coast Guard statutory missions, any potential need to create new missions or rebalance resources across missions, and the types of decisions the Coast Guard might need to make in response. The distribution of responses (i.e., point allocations) among participants provides some insight into this for the set of shocks presented in the game. In this section, we highlight particularly problematic shocks and how participants planned to rebalance resources in response to shocks. Importantly, this game illuminated a key difference between stressors and shocks from a Coast Guard perspective—namely, although stressors can introduce long-term challenges for conducting day-to-day operations, shocks stress the Coast Guard in the short term because the service is still expected to provide its regular services while also dealing with one or more unanticipated events.

Different team pairs playing the game were highly likely to face different shocks, making comparisons between pairs difficult to normalize. Moreover, given a shock, decisionmakers and adjudicators will almost certainly have different allocations because they have different information sets. Directly comparing decisionmakers to see which more closely matched their adjudicators, for example, would not be informative. We instead focused on how participants respond to the scenarios generally, with the aim of gaining structural insight into the long-range decision problems that the Coast Guard faces.
Analysis

We begin by quantitatively analyzing allocation responses to the game to examine the degree of consensus and identify differences between participants in terms of mission-hour allocations.\textsuperscript{47} We therefore measured the impact a shock has on the Coast Guard by examining the excess demand it places on individual missions, as well as the overall change an allocation requires relative to a given baseline, both as measured by Euclidean (vector) distance.\textsuperscript{48}

We first calculated the distance between the baseline asset-hour allocation provided to participants and the decisionmaker allocations in each round. Table B.4 shows these results. They describe how participants think the Coast Guard would best prepare for the risks in the 2040 world under uncertainty as set forth in the workshop.

<table>
<thead>
<tr>
<th>Mission</th>
<th>Mean Overall</th>
<th>Baseline</th>
<th>Round 1</th>
<th>Round 2</th>
<th>Overall Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homeland security</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PWCS</td>
<td>12</td>
<td>12.6</td>
<td>12</td>
<td>12.3</td>
<td>3.8</td>
</tr>
<tr>
<td>DI</td>
<td>35</td>
<td>21.8</td>
<td>17.4</td>
<td>19.6</td>
<td>6.6</td>
</tr>
<tr>
<td>DR</td>
<td>8</td>
<td>8.2</td>
<td>8.8</td>
<td>8.5</td>
<td>1.6</td>
</tr>
<tr>
<td>Migrant interdiction</td>
<td>10</td>
<td>12.2</td>
<td>11.2</td>
<td>11.7</td>
<td>2.3</td>
</tr>
<tr>
<td>OLE</td>
<td>4</td>
<td>6</td>
<td>4.4</td>
<td>5.2</td>
<td>3.9</td>
</tr>
<tr>
<td>Non–homeland security</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATON</td>
<td>1</td>
<td>1.6</td>
<td>4</td>
<td>2.8</td>
<td>2.7</td>
</tr>
<tr>
<td>SAR</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>2.4</td>
</tr>
<tr>
<td>LMR</td>
<td>4</td>
<td>16.6</td>
<td>14.6</td>
<td>15.6</td>
<td>4.1</td>
</tr>
<tr>
<td>MS</td>
<td>4</td>
<td>6.2</td>
<td>6.6</td>
<td>6.4</td>
<td>1.8</td>
</tr>
<tr>
<td>MEP</td>
<td>2</td>
<td>1.2</td>
<td>3.4</td>
<td>2.3</td>
<td>1.6</td>
</tr>
<tr>
<td>IO</td>
<td>15</td>
<td>4</td>
<td>7.2</td>
<td>5.6</td>
<td>4.5</td>
</tr>
<tr>
<td>New mission 1</td>
<td>0</td>
<td>4.2</td>
<td>4.4</td>
<td>4.3</td>
<td>4.8</td>
</tr>
<tr>
<td>New mission 2</td>
<td>0</td>
<td>0.4</td>
<td>0.6</td>
<td>0.5</td>
<td>1.1</td>
</tr>
<tr>
<td>Distance from baseline allocation</td>
<td>22.1</td>
<td>22.9</td>
<td>22.2</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: New mission is a generic term for any new Coast Guard mission (beyond existing statutory missions) discussed during the game.

\textsuperscript{47} Note that the percentage of asset-hours spent in each mission can be viewed as an economic good. An increase in asset-hours in a mission would, all else equal, increase the Coast Guard’s utility, here taken to mean the service’s overall capability to meet its mandate.

\textsuperscript{48} To calculate Euclidean distance $d$ between two allocations $u = (u_1, \ldots, u_n)$ and $v = (v_1, \ldots, v_n)$, we take $d = \left[\sum_{i=1}^{n} (u_i - v_i)^2\right]^{\frac{1}{2}}$. 

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On average, decisionmakers in both rounds made approximately the same total change from baseline (shown in the last row, distance from baseline allocation) and directionally agreed on the changes needed in every mission with the exception of MEP, which saw relatively small changes. Decisionmakers in both rounds increased asset-hours devoted to LMR by more than 10 percent and allocated more than 4 percent of mission-hours to new missions, such as cybersecurity; command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR); and new disaster-response mission; and intelligence. We discuss new missions in more detail in the next section. Decisionmakers in both rounds largely used resources from DI and IO to support these increases: Although it is not shown in these results, these two missions also had the greatest variance in allocation.

To identify problematic shocks, we looked at the difference between adjudicator and decisionmaker allocations (shown in Table B.5) to assess whether certain shocks or combinations of shocks were particularly problematic against which to plan under uncertainty.49 The first three rows of Table B.5 show the ten sets of shocks that occurred during two rounds of game play (the numbers correspond to those of the shocks summarized in Table B.3). The cells to the right of the mission labels show the difference between the adjudicator and decisionmaker allocations (i.e., excess demand) for each set of shocks. To help identify where decisionmakers had consistent shortfalls, we have highlighted excess demand greater than 5 percentage points.

On the whole, the results indicate that decisionmakers had more difficulty coping with multiple distinct shocks than they did with single or limited numbers of extreme shocks. The strain posed by additional shocks appears diminishing: Although one scenario contained three shocks, for example, it did not generate the greatest difference in resource allocations between the average decisionmaker and the adjudicators. Adjudicators allocated more resources to DI and IO missions than decisionmakers did.50 Decisionmakers appear to have therefore viewed these as the least resource-constrained missions while not fully valuing their importance across scenarios.

The scenario combining shocks 2 and 3 (illegal fish transshipment, human smuggling, and a cyber event) seemed to be the most difficult for decisionmakers. The adjudicators noted that some of the surge responses of the decisionmakers might present challenges: Engaging with partners in crisis situations is much easier with established relationships and protocols; assets cannot be retasked instantaneously and with optimal results.

49 In the context of this game, an adjudicator’s allocation describes the optimal Coast Guard posture given a set of shocks. When adjudicators’ asset-hours for a mission exceed those that the decisionmaker allocated, the results suggest that the Coast Guard might have difficulty meeting its mandate in that area under the scenario. The total excess demand (the sum of positive differences between allocations) likewise correlates with the overall shortfall the adjudicators found, given the decisionmakers’ allocations under uncertainty.

50 We note that these missions had the most asset-hours allocated in the 2018 baseline.
Before examining the detailed responses of participants, we analyzed whether the adjustment reallocations of decisionmakers improved their positions in the scenario (which we would expect to see). Analysis shows that, in all but two cases, the allocations either grew more similar between the decisionmaker and adjudicator teams or remained the same distance apart. Of the two cases in which the allocations grew apart, one scenario was extreme, while the other had multiple shocks. With respect to designing scenarios, this result suggests that scenario vetting should increase with scenario complexity.

Although these results largely suggest that participants shared a common understanding of the Coast Guard and the demands of its missions within the context of the game, some of the differences between adjudicator and decisionmaker allocations might be explained by a presumed fungibility in missions. The game purposefully gives no guidance in this area in order to provide respondents maximal flexibility. In their written responses to questions focused on
identifying shortfalls and consequences, some participants did indicate that resources allocated to one mission might translate to needs in another mission. For example, as adjudicators, team 4 critiqued team 10’s allocation, saying, in part,

Migrant interdiction would be a huge challenge. The AMO [air and marine operations, also known as migrant interdiction] gap may be mitigated [by] an uptick in OLE. It depends . . . since they are different mission sets, but they do use similar resources which could be an easy shift: this helps mitigate.

This result suggests that scenario development can benefit from understanding relationships between Coast Guard missions and their underlying capabilities and precisely how these capabilities support different mission objectives.

In responses to follow-up questions after the game, participants also identified consequences of mission shortfalls. For the most part, responses focused on the mission level, describing changes to overarching mission objectives, such as decreased DI (or increased drug traffic), decreased migrant interdiction (or increased migrant flows), or reduced economic activity for the United States or its partners. A small set of responses extended this set to include loss of a commercial fishery, increase in unchecked TCO activity, increased risk of environmental pollution, and others. Overall, the set of consequences generated for the workshop suggests areas for further inquiry or for possible scenario development while raising deeper questions about mission objectives and the implications of shortfalls. Ultimately, scenarios need to reflect a clear understanding of mission objectives and their metrics for success to quantify their potential impacts on Coast Guard operations and support better decisionmaking.

In response to follow-up questions, participants described specific, real-world strategies that they would take to mitigate scenario consequences. Some responses spoke simply about increasing investment (or surging) in one or more missions. Although we asked participants to consider short-term versus long-term investments (for decisionmakers and adjudicators, respectively), responses often overlapped and blurred the distinction. In Table B.6, we connect the more-specific strategic options that participants identified with the missions they considered most strained by their scenarios. For future scenario development, this list provides a sample of the types of strategies available for Coast Guard planning and decision analysis.
Table B.6. Identified Strategic Analogues, by Statutory Mission

<table>
<thead>
<tr>
<th>Mission</th>
<th>Strategic Analogues Identified by Workshop Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Homeland security</td>
<td></td>
</tr>
</tbody>
</table>
| PWCS                         | • Partner with other nations, DoD, and agencies.  
|                               | • Improve the organic radiation detection capability.  
|                               | • Develop protocols for scenarios to facilitate interagency cooperation.  
|                               | • Provide more national and international humanitarian aid and disaster-relief planning (direct effects on districts 7, 8, and 11 but important for all districts).  
|                               | • Implement deployable communication capability using high bandwidth.  
|                               | • Deploy national security cutters.  
| DI                           | • Retreat to the Green Border, doing DI only on U.S. land, not on the water (hand off to other agencies).  
| DR                           | • Implement homeland security patrols.  
|                               | • Partner with DoD.  
|                               | • Increase interoperability.  
|                               | • Deploy national security cutters.  
| Migrant interdiction         | • Increase dedicated surge capacity and capability using a reserve force.  
| Non–homeland security        |                                                                                                                                                                                        |
| ATON                         | • Be prepared to sacrifice contingency gained from GPS.  
|                               | • Allocate resources to verification of navigation capabilities of a contingency fleet.  
|                               | • Create a resilient positioning, navigation, and timing or backup electronic navigation system.  
|                               | • Preserve physical ATON.  
|                               | • Implement resilient timing for communication.  
| SAR                          | • Accept longer response times for rescues and flood response to prevent loss of life.  
| MS                           | • As part of an oceanic or MS initiative, partner with the Navy to support a surge.  
| MEP                          | • Partner with other nations, DoD, and agencies.  
|                               | • As part of an oceanic or MS initiative, partner with the Navy to support surges.  
| IO                           | • Invest more in international affairs and relationships to offload responsibilities.  

New Missions and Rebalancing Priorities

The results of this game indicate that many of the participants recommended considering whether cybersecurity, disaster response, or intelligence could be considered as a new, separate Coast Guard mission. Table B.7 identifies the new missions put forward along with the shocks with which they appeared and the number of decisionmaker and adjudicator teams that called for them. Although cybersecurity; C4ISR; command, control, communications, computers, cyber, intelligence, surveillance, and reconnaissance (C5ISR); and intelligence might, to some extent, represent similar missions, we report them separately here to represent the results directly. The cybersecurity mission had the most participant teams recommending it as a new mission and was attached to almost every shock, as well as the lone Business as Usual (no shocks applied) scenario. Interestingly, almost no adjudicators called for a disaster-response mission, while four decisionmakers did. This result suggests that, although decisionmakers can prepare for disasters...
in advance, short-run decisionmakers might find value in the flexibility of a dedicated response capability.

<table>
<thead>
<tr>
<th>New Mission</th>
<th>Associated Shock</th>
<th>Number of Teams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cybersecurity</td>
<td>x x x</td>
<td>3 3</td>
</tr>
<tr>
<td>C4ISR or C5ISR</td>
<td>x x x</td>
<td>1 1</td>
</tr>
<tr>
<td>Intelligence</td>
<td>x x</td>
<td>1 1</td>
</tr>
<tr>
<td>Disaster response</td>
<td>x x x x</td>
<td>4 1</td>
</tr>
</tbody>
</table>

As we review these potential new or evolving mission areas in a broader context, the need for increased cybersecurity emerges from Coast Guard–operated systems’ and entities’ growing vulnerability to cyberattack, with potentially cascading consequences on the MTS. Cybersecurity is also critical for the Coast Guard to be able to protect its own capabilities at a time when it is ever more dependent on information technology. Creating a single mission to administer these capabilities integrally across the Coast Guard would allow these issues to be addressed systemically rather than in parallel across units.

In connection with this idea, participants discussed the possibility that the Coast Guard could shed some current missions. Some participants suggested that advances in electronic navigation, realized through resources devoted to a cybersecurity mission, could diminish the need for the Coast Guard to emplace and maintain ATON, or even eliminate that part of the ATON mission altogether. Alternatively, participants suggested, some responsibilities for ATON could be outsourced, as could aspects of the IO and MEP missions.

With respect to the other new missions discussed, although the Coast Guard has long conducted disaster-response operations both domestically and abroad, several teams made the case that the increased frequency, severity, and impact of disasters could potentially justify designating this as a separate mission. An increased focus on intelligence can also be justified as information becomes more ubiquitous: The ability to rapidly collect, integrate, analyze, and disseminate findings based on that information can have an even greater impact than intelligence has traditionally played in Coast Guard operations.

Other teams acknowledged that these areas are important but argued that it might be advantageous to treat them as functional areas whose importance will be elevated in the future. Increased preparations and planning for disaster response, as well as increased resources devoted to intelligence as a supporting function, could strengthen overall Coast Guard capabilities without the separate administrative structure that a new mission would create. This critique perhaps echoes the difference between decisionmakers and adjudicators: With perfect information, growing capabilities within current missions to meet the future seems feasible. But
in the face of a real, adverse shock, prior dedication to an appropriate mission can have significant value.

In some instances, teams identified specific investments or actions associated with new missions in their responses to follow-up questions. As with other responses, many of the ideas focused simply on increasing or creating the stated mission. Table B.8 summarizes the more-specific responses. Although the game did not draw out distinctions between the new missions that participants identified, the results suggest significant overlap between the cybersecurity, C4ISR and C5ISR, and intelligence missions. With respect to the disaster-response mission, investment in surge capability raises the question of surge effectiveness generally: What challenges does the Coast Guard face in making quick changes to respond to disasters, and how would prior investment in surge capacity—whether among active-duty or reserve personnel—improve outcomes? Future scenario development can further investigate the relevant trade-offs for these and other investments related to new missions.

<table>
<thead>
<tr>
<th>Table B.8. Specific investments in New Missions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>New Mission</strong></td>
</tr>
<tr>
<td>Cybersecurity</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Intelligence</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>C4ISR and C5ISR</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Disaster response</td>
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<tr>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

From the perspective of scenario design on these ideas, the strategic concept of a new mission remains nebulous. Establishing a new Coast Guard mission can mean several things. The concept, as revealed by the Future Shock game results, embodies systematic attention to similar problems across all of the Coast Guard and a single “owner” for them, singular attention to a defined set of training and acquisition questions, responsibility for preparedness for a related set of implicit scenarios, and perhaps the redistribution of some objectives of other missions. Further
research can explore exactly what it would mean to create a new mission for the Coast Guard and what its operational implications would be.

Future Shock Game Summary and Lessons Learned

Expert participants in the Evergreen workshop Future Shock game demonstrated a largely consistent, shared understanding of the scenarios’ impacts and their implications for the Coast Guard. This analysis nonetheless highlights important differences that can be investigated in the course of scenario development. Participants differed in how much to deemphasize DI and IO and how much to invest in a set of new missions. Fungibility between missions—the degree to which investments in one mission could meet demands in another—was also a matter of debate. Although the future world created for this exercise is highly specific, its basis in current trends suggests that these topics could be generally useful for strategic consideration. Future scenario development can also investigate and account for trade-offs between mission-specific investments and utility investments that can address demands across missions.

Although the scenarios in the game specify consequences of the shocks that occur, we ultimately want to understand what the implications of those shocks are for the Coast Guard in terms of mission objectives and their success metrics. The results of this game provide an initial window into some outcomes of concern for the Coast Guard. Future scenario development can draw out consequences more explicitly with an eye to quantifying impacts. These measures can then inform a suite of decisionmaking tools to support scenario analysis.

Scenarios will also need to reflect strategic options available to the Coast Guard, particularly when they are relatively long run and irreversible in nature. As an exploratory tool, this game asked participants to make decisions at the more abstract level of mission-hour allocations and then provide detail on what those decisions might mean in terms of real-world analogues. The set of options described provides an initial look at the types of strategies available to the Coast Guard. Future scenarios can build on this set and draw out critical cost and benefit considerations to inform decisionmakers.

Finally, with respect to lessons learned on the Future Shock game design and implementation, our HSOAC team overall found the results useful and informative. Although the game used quantitative allocations to ground and guide participants in their written responses, the absence of quantified consequences for mission shortfalls prevents objective scoring of team allocations. That circumstance does not diminish the game’s value as an exploratory tool, but such metrics could support later evolutions of this game. In its current form, the brevity of the written responses in the game suggest that teams could use more time to compose their answers. Related to both of these observations, several game participants requested that next iterations or adaptations of this game provide a mechanism for teams to get more feedback from their peers via a larger discussion among teams, perhaps involving a defense of their allocations. We will use this feedback when designing future workshops.
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DCO—See Deputy Commandant for Operations.

DCO-X—See Office of Emerging Policy.


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The U.S. Coast Guard’s motto is *Semper Paratus*—always ready. But for what? The service carries out 11 diverse statutory missions and must address both immediate needs and future contingencies, which makes this question difficult to answer. Future changes to the operating environment in the physical, economic, social, political, and technological domains promise additional stresses on service resources, in addition to changing the makeup of the service itself.

One way to aid decisionmaking in the face of a deeply uncertain future is by more effectively leveraging the Coast Guard’s Evergreen strategic foresight initiative. Analysts from the Homeland Security Operational Analysis Center adapted an approach to developing future scenarios and, in this report, present example components of Coast Guard global planning scenarios related to future service readiness. These posture the Coast Guard to better integrate slow-burning issues and problems that might emerge only down the road into nearer-term decisions that can help prepare the service for upcoming challenges.

Without weighing the long view of changes in the operating environment alongside current or nearer-term demands, the Coast Guard will not be able to have full awareness of what blind spots might exist in current strategies and plans. Being ready for the spectrum of challenges the future might bring requires mindfulness of both the near and long terms and how change will affect the Coast Guard.